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NEW ELECTRICAL INVENTIONS.

Whether by a mere coincidence or as indicating a revival of the inventive faculty in the higher ranks of electricians, our patent record this week contains an unusual number of patents coupled with well-known names, most of which recall the first years of electrical development. Among these names we find Thomson, Houston, Jenney, Scribner, R. M. Hunter, E. H. Johnson, J. F. Kelley, Cuttriss, Silvey, Haskins, Kester, A. Langstaff Johnston, Doane and several others well known in electrical circles. We give an extended account in our columns of several of the inventions, and others of interest that might have been added are omitted from lack of space. One of the most interesting of the various devices is the thermostat of Mr. Chas. Cuttriss, which seems to be the first time the remarkably simple principle upon which it is based has been applied to this purpose.

DEATH BY ELECTRICITY.

In this issue the Digest gives an account of some experiments on the effect of alternating electric currents on animal organisms, described in a paper read before a recent medical congress at Rome, Italy, and which corroborate the views of D'Arsonval, referred to recently in these columns. The current used was an alternating one, and it was found that animals subjected to from 1,500 to 2,000 volts were not easily killed, and that death resulted mostly from asphyxia caused by the sudden stoppage of respiration. Frequently breathing started again spontaneously and the animal recovered completely. In no case was there any physiological change noted, though in a few there were mechanical lesions, in themselves cause for death. This further confirmation of D'Arsonval's formula, "A man shocked by electricity should be treated as if drowned," renders it still more important that the electrician should make himself acquainted with the proper means of resuscitation from the effects of electric shock.

STORAGE BATTERIES FOR ELECTRIC POWER STATIONS.

We recently commented upon the use of storage batteries in the power station of a street railway at Zurich, Switzerland, and the Digest this week gives some further particulars in regard to the same plant. The saving in this case, if we can accept the figures given as strictly correct, is very marked, being no less than 2.2 lbs. of coal per h. p. hour, which amounts to more than a ton a day, or sufficient to pay for the storage battery plant in four years. As the adoption of the battery system, however, actually reduced the first cost of the plant on account of replacing more expensive machinery, the saving is a direct one, and in a comparison should be credited with the interest charges on the reduction in first cost and with the maintenance charges of the machinery displaced. It will be noted that the voltage of the discharge side is kept constant by automatically cutting in and out regulating cells, which are apparently charged from a separate dynamo. This does not seem to be actually necessary, though the economy of operation in keeping the line voltage constant is somewhat increased thereby. The results achieved with this plant are very encouraging, and strongly confirm the conclusions stated in the excellent paper on storage batteries for power stations read at last year's annual convention of the American Street Railway Association by Mr. C. O. Mailloux. We trust that it will not take so long for the matter to be taken up on this side of the Atlantic as did the use of storage batteries in central station work.

ELECTRICAL DUPES.

Barnum's saying that "Americans love to be humbugged" certainly seems to apply in electrical matters, though in this respect the distinction made in regard to nationality is questionable, for

Europeans appear to bite as eagerly at an electrical bait as Americans. We must confess to having little sympathy with most of these victims, for as a rule they seem to have become the prey of their own vanity—thinking that their crude habits of thought are sufficient to form a judgment of greater weight than that of scientific authorities. One of the most barefaced electrical swindles in existence has been reaping a harvest from this class for seven or eight years, and although it has been so repeatedly exposed that few or any of those who invest in its promises can be ignorant of the manner in which it is regarded by all electricians, yet the returns seem to be as flourishing to-day as at the beginning. The system to which we refer claims among other things that by means of its apparatus 20 horse power can be put into a boat and "100 horse power—yes, 200 horse power" delivered to the propeller shaft. It is interesting to note the arguments used, which have been remarkably successful in their results. There seem to be only two of these, one to dispose of critics and the other to cover up the improbability of the claims. The former one is that the system would so entirely annihilate all of the established electrical companies that these have entered into a conspiracy among themselves and with the electrical press to depreciate the invention and persecute the inventor, which accounts for the ridicule of the former and the defamation of the latter. In answer to criticisms as to the improbability of the invention, it is pointed out that all great inventions have been similarly regarded; that the incandescent lamp, the telephone and everything that was new to the theoretical fellows were called impossibilities, but nevertheless netted great fortunes to the shrewd investors who were not imposed upon by book twaddle. It is a curious commentary upon the weakness of human nature that these arguments, in the face of the fact that the apparatus has been before the public for years without demonstrating its claims, should have the potency they have, and apparently always will have. The dupes who are imposed upon by such specious means are to be classed in the same category with of the hayseed customer of the "green goods" man, and, from electrical people at least, are likely to receive as little sympathy.

CONSULTING VS. CONTRACTING ENGINEERS.

Our esteemed London contemporary, *The Electrical Review*, has again returned to the subject of contracting engineers acting as professional consultants, against which practice it is emphatically opposed, and good reasons are offered for the ground which it takes. The contractor, it is stated, must, by the very nature of his business, be necessarily biased in his judgment, and with a human tendency to recommend what will best further his firm's present or future interest. For the purchaser to get the most perfect plant and that most suitable to the conditions under which it will have to work, the employment always of a competent professional mechanical and electrical engineer—one with unbiased, independent and wide views and in no way connected with any manufacturer or contractor—is urged, thereby enabling full advantage to be taken of the wide field of electrical science and its continuous development. That this should be the course of the purchaser seems obvious, but in this country it is nevertheless seldom the one adopted. Until quite recently the engineers of electrical selling companies were also the engineers of the purchaser, and one result has been that, owing to competition and therefore the necessity of cutting down a bid to the last penny, the plants thus designed have as a rule been far from what they would have been if laid out by disinterested engineers inclined to take other matters into consideration than the lowest possible first cost. It is very much to the credit of the various manufacturing companies that the result of this system has not been much worse than it has proved, for the tendency would seem to be almost irresistible to sacrifice everything to bring the figures of a bid to the lowest possible notch. It has often been remarked that in the United States electrical plants are far inferior to European ones in engineering design and efficiency, and it is natural that this should follow from the system above referred to. Although, of course, the cost of such plants has been much less relatively than in Europe, yet the lack of other important elements in most cases has overbalanced this, for in laying out and installing machinery, low first cost is usually a bad criterion to follow exclusively. Another disadvantage is that such a system discourages development, for it leads to the adoption of so-called standards in order to cheapen manufacture, with the consequence that frequently new principles cannot be adopted at once without an expense that would often not offer an equivalent advantage in the judgment of a purchaser lacking disinterested professional advice. This is probably the reason why in central station machinery we were some years behind European practice, and why the adoption of improvements like direct-connected machinery and others has been by jumps rather than by a gradual process of amelioration. While, therefore, it seems to be the part of wisdom for a purchaser to employ an engineer as a professional adviser, it does not follow that the latter should be deaf to suggestions from the engineers of contractors, who, in this country at least, are often the most competent men in the profession, and with exceptional opportunities to keep thoroughly posted in all details. The role of the former should rather be confined to that of referee, and though it might sometimes be advisable for him to draw up a skeleton plan, most of the details could with advantage be left open until the suggestions of contractors had been carefully weighed. This, we believe, is the course usually followed in preparing the specifications for electrical machinery, but the opposite rule appears to obtain in contracting for the wiring of large office buildings, though this is the case where most advantage might be gained from meeting the contractor half way. To draw up satisfactory wiring specifications for a large building from architects' plans is not a simple matter to one not actually engaged in installing such work, and in almost every case better results would probably be obtained by asking for bids on contractors' own plans, based on general requirements as to drop, materials and workmanship. Owing to competition, it would be to the interest of the latter to be guided by economical considerations throughout, and the saving in this respect would perhaps justify the offer of prizes, as in architects' competitions, to defray the cost of preparation of the specifications not accepted but nevertheless found to be meritorious.

The Measurement of Polyphased Currents.

To the Editor of The Electrical World:

Sir:—In a recent article, published in your journal in the issue of June 23, on "The Measurement of Polyphased Currents," by A. D. Lunt, I see my name cited (p. 832) in relation to a certain formula. From the way in which Mr. Lunt presents the matter, it might be supposed by the readers that he is the author of the more general formula,

$$P = \Sigma \frac{1}{T} \int_o^T i\,(v - v_o)\,dt, \qquad \text{(p. 805)}$$

applicable to all known systems of polpyhased currents, for he follows it with this remark (p. 832): "Hitherto the above results have been reached, either in a less natural way, or on an assumption based upon the form of the circuit in which the energy is utilized." Mr. Lunt also seems to present as his own the method of multiple wattmeters (mechanical combination of wattmeters).

In reality, this method, the above general formula, and all the deductions have, on the contrary, been brought out in my paper in *La Lumière Electrique*, January 21, 1893, page 139 (Sur la Mesure des Courants Polyphasés), from which Mr. Lunt claims to have borrowed only one formula of small interest. My article even ends with words which are almost identical with those of Mr. Lunt: "The foregoing demonstration is more general than those given heretofore; it does not make any assumption on the form of the circuit of utilization." I beg you to kindly call the attention of the readers of your esteemed journal to this fact, in order to avoid a misunderstanding.

This entire question is, besides, so extraordinarily simple that it is difficult to understand the protracted search that has been made for complicated formulas and demonstrations. I would not have thought of writing this letter, referring to a matter of so little importance, if Mr. J. D. E. Duncan, after a complicated and less general demonstration, had not recently formulated this surprising opinion: "An analytical proof for a perfect general case is too complicated to be followed easily" (E. W., June 9, 1894, p. 763); but it seemed to me that this statement should not remain unanswered.

A. BLONDEL.
Ecole Nationale des Ponts et Chaussées, Paris, France.

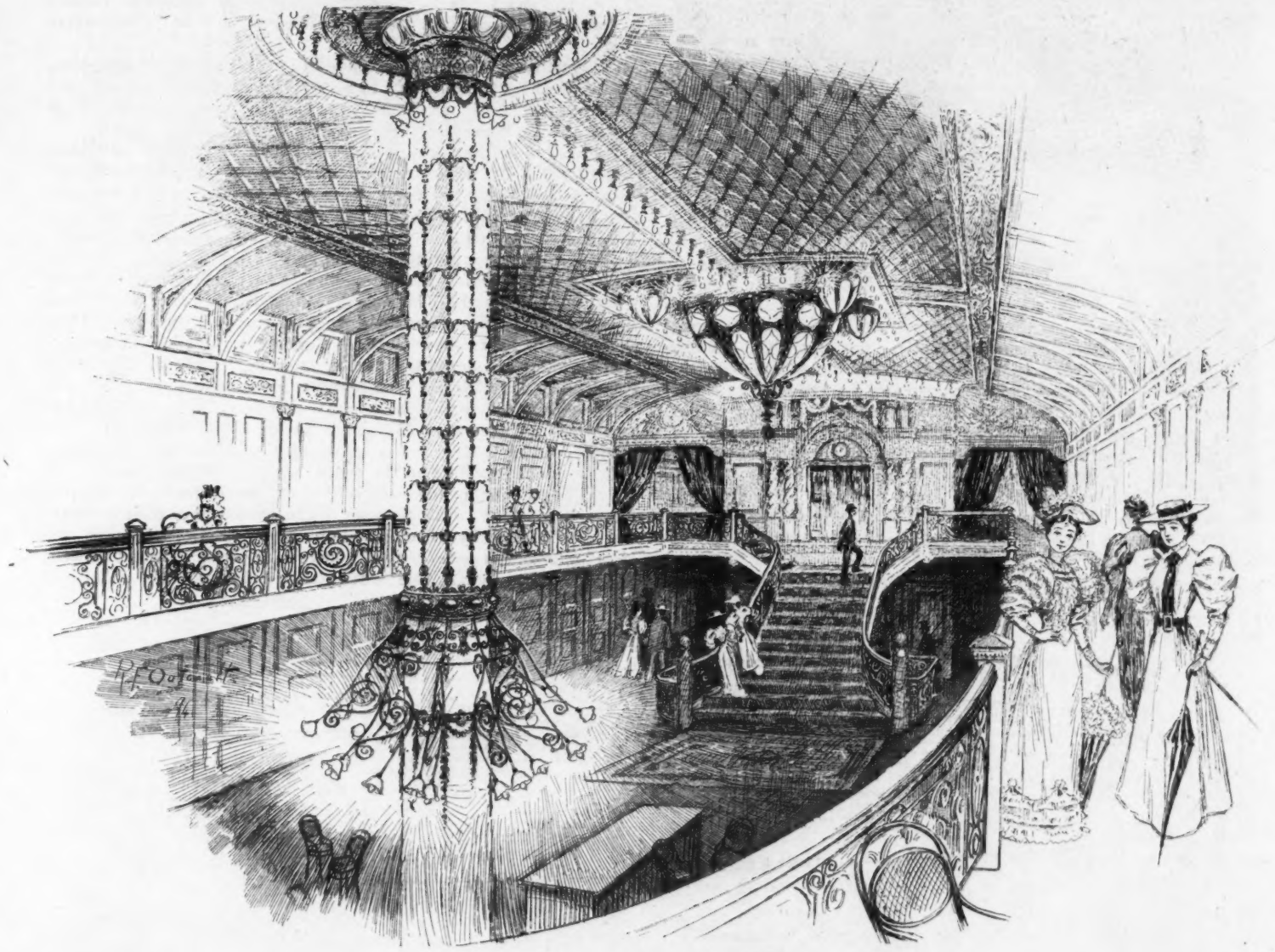
Electricity on the Sound Steamer Priscilla.

Of all the imposing sights which the traveler over the great bridge suspended in midair between New York and Brooklyn can behold, none is more singularly striking than the procession of steamers which passes beneath that airy arch a few minutes after half-past five each evening, carrying hundreds of busy people from New York and her sister cities to different points on the eastern coast, thence to be disseminated into the bustling New England States. The deep boom of a steam whistle sounds upon the air from a source hidden by the massive buildings of the southern end of the city, and in a few short seconds the huge nose of a huger steamer is pushed into the field of vision as it rounds the point of the Battery, and a broadside view is momentarily had of an immense leviathan, whose storied sides glisten white in the western sunlight against the sombre green of Governor's Island and the purple uplands of Staten Island as a background, as it moves across and slowly turns in a wide sweep into the East River. Another whistle, and the coughing tugs and lumbering ferry craft of antique and uncouth pattern take to flight.

The tall structure advances, throwing from her sharp bow two curling narrow white ribbons of water which pass down either side and are swallowed up in the heavy foam, churned up by the feathering paddles of the side wheels and passing in converging lines into the distance.

Her advance is now swift, although she is traveling at modulated speed, and the spectator on the bridge soon distinguishes the individuals in the crowded mass of living freight upon her decks, outside, like himself, to witness and enjoy the passing show. Still nearer, and as he looks down, he sees beneath him through the bewildering network of the bridge structure a long, gray ellipse, whose even surface is broken only by the two black cavernous apertures of the smoke stacks, and much fluttering bunting, which passes rapidly, and strikes out into relief as tier upon tier of her galleried and decorated stern, set in a foaming, eddying mass of seething water, rise and move forward from beneath the suspended roadway. The smaller craft on each side of her rock madly in the waves which the huge mass propelled through the water creates, but she recks little of them as she passes grandly on, a marine object of singular beauty, more stately than any other floating thing on sea or ocean, until she disappears from sight behind the extreme easterly point of the island.

Such is the Priscilla as she moves at the head of the evening procession. She is the grandest and largest of her class, and her appearance is the signal for a cessation of pedestrian travel on the bridge. Man, woman and child stop to watch her progress between the great gateway of gray masonry and iron which spans the opening to the Sound.



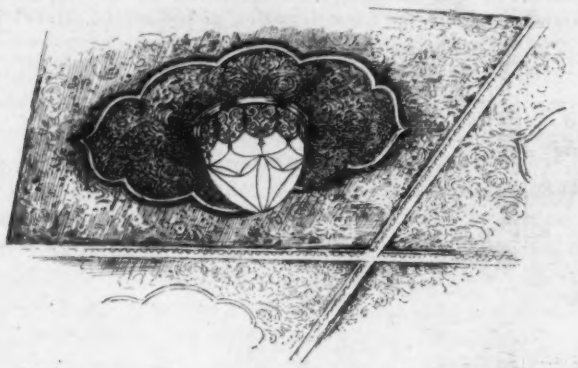
GRAND STAIRCASE FROM MAIN SALOON.

The Priscilla is the latest addition to the Fall River Line fleet, and embodies within herself all the latest improvements, architectural, mechanical and electrical, and exemplifies the high pitch to which the ship building art has been brought in this country. Following the lines of structure of purely American design, she differs radically in appearance from any steam or sailing craft to be found in foreign waters, and while she affords a pleasing spectacle to American eyes, she is something more than a surprise to those from other lands who have just come hither. Seen from the deck of a ferry boat, she looms up like a many-storied hotel, and her huge yet graceful proportions dwarf into insignificance everything near her afloat.

Her dimensions are as follows: Length over all, 440 feet 6 inches; length on water line, 423 feet 6 inches; breadth over guards, 93 feet; breadth of hull, 52 feet 6 inches; depth of hull, 20 feet 6 inches; tonnage, 5,398.

She is made just narrow enough to admit her to the widest dry dock in New York. Mild steel enters into the construction of this boat in every part. Her double hull is of steel, and in framework and structure it plays the leading role. In the saloons and cabins, hidden by the architectural and artistic effects, steel trusses spring from the decks at the bases of the walls on either side, and develop into arches upon which the different superstructures rest. Braces and knees of steel are placed everywhere where they can add to the strength and resistance, and all this metallic skeleton work renders the Priscilla one of the staunchest of marine edffices.

As the passenger crosses the gang plank laid from the wharf,



A Panel in the Dining Room Ceiling.

which is no exception to all the wharves which disgrace the magnificent water front of the metropolis, he steps upon the quarter-deck, which is the entrance hall to this most sumptuous of peripatetic hotels. This is of generous proportions and stretches aft of the engine room from side to side of the vessel. The floor is laid with a purple gray Venetian conglomerate with an elaborate border. The walls are of a delicate cream color, the salient curves and foliates being emphasized by judicious gilding. As this is the first room entered, it may as well be noted that the entire interior decoration of the saloons, with one exception, which will be noted hereafter, is in delicate half-tones, creams and pearl grays deepening into light browns.

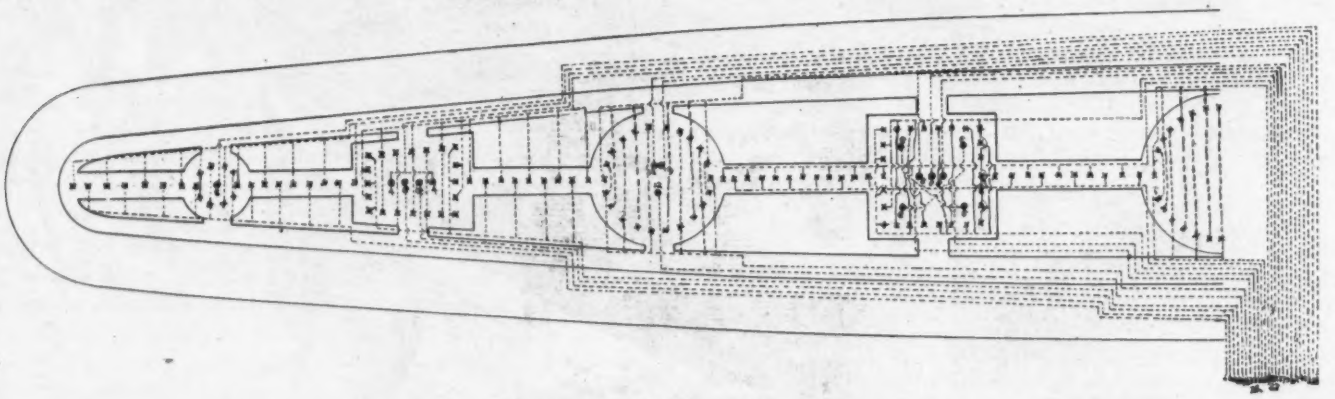
Eight stanchions or round pillars of steel spring from the quarter-deck and support part of the saloon deck above. Each stanchion, colored deep mahogany red, has a capital of light, which is made up of a polished ornamented brass tulip, the petals of which are of opalescent glass, in the interior of which, like the stamens of the flower, are twelve incandescent lamps. Around the hall is a dado and above this is a succession of twelve panels, of which two are curved, all especially designed for the Priscilla. They are supposed to be emblematic of the differents arts and sciences which contributed to the construction and purposes of the boat. Commerce, Machinery, Architecture, Electricity, Music, Dancing, etc., etc., and, as befits the case, one is devoted to Priscilla herself turning her spinning wheel in her cottage of Colonial days. The frieze is highly ornate and runs entirely around the hall. On each side of the hall is a room, one the purser's office and the other the barber's shop, lighted by a four-light chandelier and four two-light clusters.

Between the quarter-deck and the dining-room, which is also on the main deck, is a vestibule, to which entrance is gained through swinging glass doors. From this the passenger passes into the dining-room. This is a spacious and lofty room running aft, provided with broad windows opening out upon the water upon each side. Between the windows are large mirrors, framed in ornamental woodwork. The scheme of decoration is sombreness and richness. The carpets are dark, the highly decorative woodwork is of mahogany, and the chair and window seat coverings are of dark olive-green leather. The scheme of lighting is bold and successful. Over each window is a box with stained glass sides, upon which is worked a beautiful design, each of which contains ten 16 c. p. lamps. Similar glass receptacles are placed over the doors and mirrors at each end of the room. The ceiling is finished in beams and straps of mahogany, and panelled. Each panel has a medallion in the centre, and each alternate panel an electric "pendant." This pendant is an elliptical bowl of opalescent glass, held in a rope net of brass and containing two 16-c. p. lamps. There are six rows of these from side to side of the cabin. On each side of the sideboard at the after end are two niches, in front of each of which hangs a basket pendant of opalescent glass containing an incandescent lamp.

Still further aft, and on each side, are two private dining-rooms, each lighted by five elliptical bowls forming quincunx, a large one in the centre, and four others, one at each corner in the panel immediately over the table. Aft of these are the ladies' cabins.

The lights in the dining-room are controlled from two panel switchboards set under one sideboard on each side. These panel boards will be described when we speak of the electrical equipment. Altogether there are 305 lights in this room.

Returning and passing through the dining-room and quarter-deck, the passenger ascends the staircase, with wrought iron and mahogany balustrade, into the main saloon, which runs the entire length of the vessel. The stairway is lighted by three bull's eyes in the arch. This saloon is the drawing-room of the vessel. It is decorated and furnished in most pleasing style, and yet all the ceiling and mural decorations are of nothing more than moulded papier-maché, which has been found more durable than wood and better capable of lending itself to artistic effect. It is all colored in half-tones of creams and light browns, picked out with gilt. The carpets and upholstery are of a warm tint, admirably contrasting with the delicate colors on the walls. A wide elliptical opening aft of the engine room causes the ceiling of the dome to be in part that of the saloon. The lighting of the saloon other than from the dome is effected by three eight-light electroliers set between the stanchions, and a series of two-light brackets set all around between the state-room doors. The mast passes up through the saloon and



Circuits of Gallery Deck.

carries a highly ornamental fixture at the height of the gallery deck. In this fixture, from a central band, branches bend down and out and carry at their terminals frosted incandescent lamps set in opalescent globes. In the forward saloon the mast has no fixture.

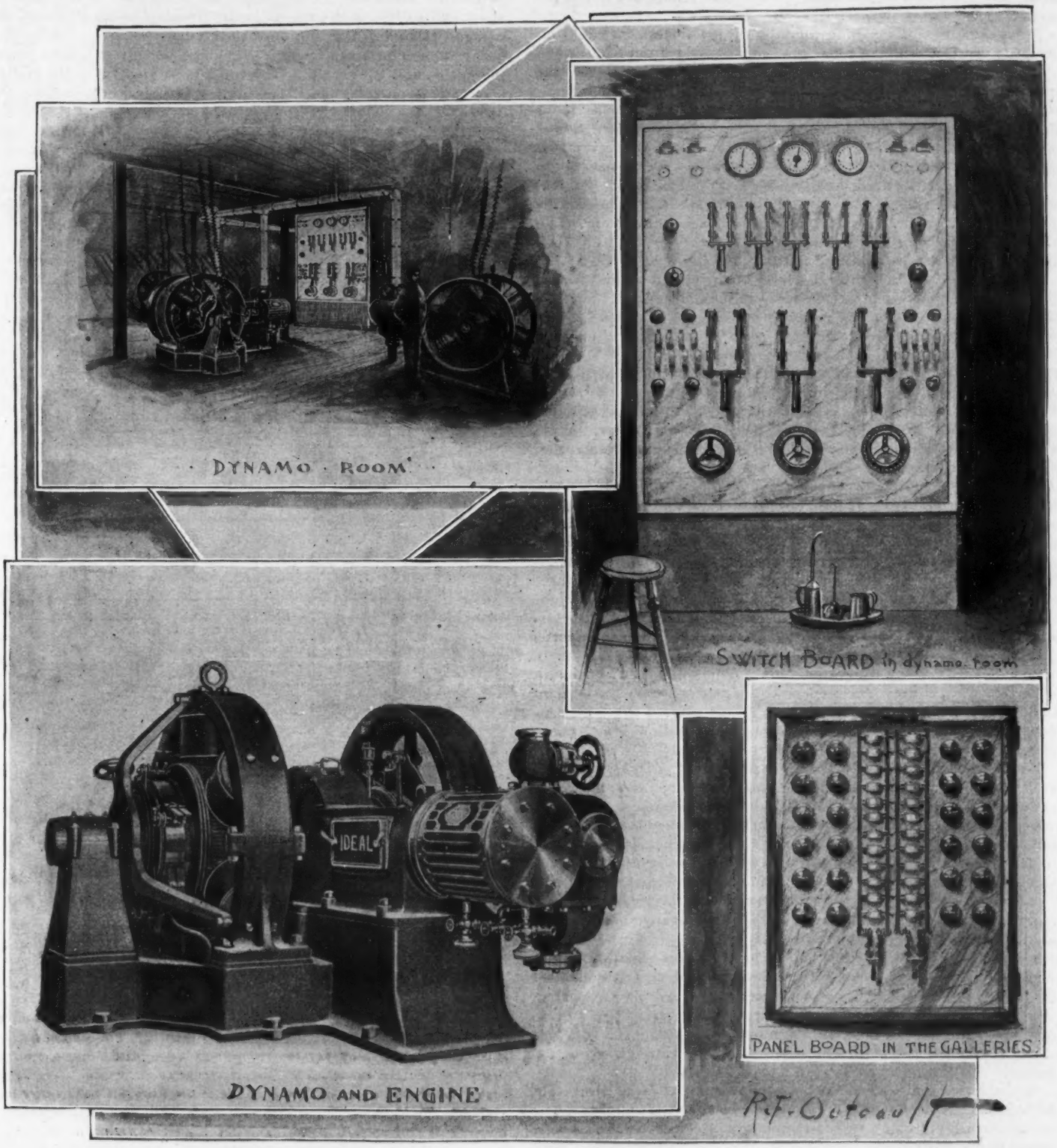
At the forward end of the main saloon is the grand staircase leading to the gallery deck. The bulkhead at the head of this is the chief ornamental feature of the whole boat. It is an imitation *en grande* of an old-time *cheminée*, with twisted columns on either side of a large central mirror, a floral device lying within the convolutes. Over the mirror is a gilded clock, set in a semicircular mosaic, in which the only example of bad taste on the whole boat is to be found. This mosaic is a mixture of blues, reds and greens in glaring tonality, which jars on the nerves and quarrels with all the other delicate half-tones which prevail. A four-light bracket with upright lights is set on each side of this mirror. The passages are lighted by means of pretty sprays, each carrying three lights, and the toilet rooms are indicated by red globes with the usual legend. Staterooms lighted by one-light brackets open out on either side of the saloon and gallery.

The scheme of lighting of the dome is both beautiful, intricate

and effective. The principal feature is the central fixture, which takes the form of an inverted dome of brass work of complex pattern, in which are framed panels of opalescent glass. This is dependant from the ceiling half-way between the bulkhead of the gallery staircase and the mast. Within this inverted dome are 48 lights. It is set in the ceiling in a quadrangular medallion, at each corner of which is a much smaller inverted opalescent dome. Further aft is another large inverted dome of somewhat smaller proportions, attended by two lesser satellites, one forward and one aft of it, and still further aft another single inverted dome. Starting at the bulkhead is an inverted ridge of frosted lights in the ceiling, the sockets being set in metal tulips. This breaks into a quadrangular bower around the large central fixture, a circle around the mast, a narrow quadrangle around the second dome fixture, and a circle around the third. In the forward saloon two eight-light electroliers are the main features.

The lighting of the gallery saloon is carried out on a similar plan to that of the main saloon. It of course benefits from the lighting of the fixtures just mentioned. In addition it has one twelve-light electrolier in the forward saloon, and a row of twelve incandescent lamps around the mast. Forward of the gallery saloon are the cabins of the president, captain and the principal officers, lighted by electroliers and brackets. Upon the dome deck are constructed the cabins of the lesser dignitaries and the pilot house.

The lighting of the decks and all the other parts of the vessel in which the public is not supposed to penetrate, such as the crew and waiters' quarters, kitchens, boiler rooms, etc.—in other words, the working quarters—is effected by means of lanterns, some hung as pendants, others arranged horizontally against the ceilings, all protected by cages and wherever moisture can reach them with watertight globes and sockets. Those on the decks which could be confused with the ship's signal lights are obscured in front by



DIRECT CONNECTED DYNAMOS, MAIN AND PANEL SWITCHBOARDS.

curved pieces of sheet iron, which effectually prevent the light from streaming forward. In addition to the lights just mentioned, there are the side lights, masthead, bow and stern lights.

The distribution of the lighting is as follows: Dome deck, 9 circuits, 55 lights; gallery deck, 68 circuits, 596 lights; saloon deck, 44 circuits, 360 lights; main deck, 78 circuits, 748 lights; lower deck, 12 circuits, 92 lights; hold, 18 circuits, 136 lights; total, 229 circuits, 1,987 lights.

From these figures some idea may be gained of the intricate construction work which had to be effected.

Turning now to the mechanical equipment of the Priscilla, the engine room is its most important feature. This is a spacious room, rising clear into the dome, and from its floor the engineer looks down upon the two pairs of long steel piston rods, and two pairs of similar rods running from the knuckle joints to the huge cranks. The engine is double inclined compound, with two 51-inch high-pressure cylinders forward, and two 95-inch low-pressure cylinders aft of the crank shaft. The piston stroke is 11 feet. These were built by the W. and A. Fletcher Co., of Hoboken, the contractors for the vessel complete. This room is lighted by four five-light electroliers and numerous bulkhead fixtures, 129 lights in all.

Iron stairways lead down to the level of the cylinders, and in this part of the engine room the temperature becomes torrid, and the serviceable little Lundell fan motor is called into requisition. The condensers occupy each side of the room, as do two circulating pumps; the bilge pump is placed on the port side.

The ten boilers in the hold are Scotch return tubular, each having three corrugated furnaces, giving a total grate surface of 850 square feet. The boilers are 14½ feet long and 14 feet in diameter, are constructed for a working pressure of 150 pounds per square inch, and have an indicated horse power of 8,500. They are arranged for natural or forced draught.

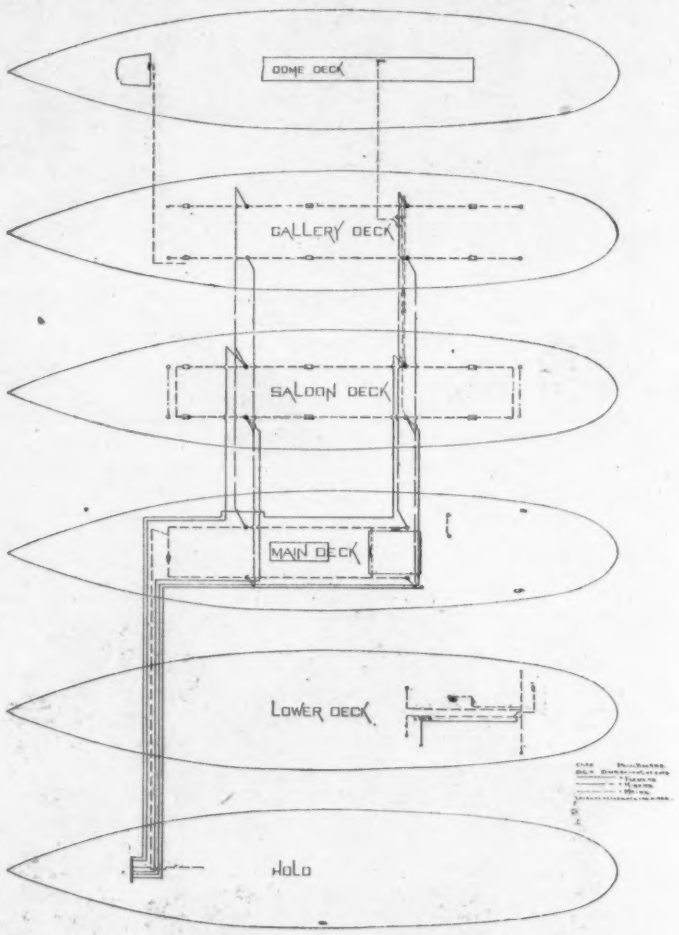
The electrical equipment of the Priscilla is a masterpiece of electrical engineering skill. It forms the most extensive isolated marine electric light plant ever installed, and consists primarily of three direct driven units located forward of the boiler room in a space in which it would be difficult to swing the traditional feline. Standing with his back to the switchboard, the spectator sees three engines arranged radially with the cylinders almost touching him, one directly in front and one on either side. These are 11x12 Harrisburg Ideal engines, with outboard bearings, from the Harrisburg Machine Works, a type which has become very widely known in connection with direct connected work. The automatic self-oiling arrangement is entirely enclosed, and the motion of the piston is so smooth as hardly to occasion a tremor. The engines are both condensing and non-condensing, and are bolted to yellow pine frames fastened to the inner hull.

Upon the bed plate of each engine is arranged a 50 kw. six pole 275 revolution General Electric multipolar generator having a capacity of 400 amperes at 125 volts. These are of a type also widely known as highly efficient machines. They have ironclad armatures, that is, the copper bar armature windings are embedded in the armature body, and the movement of the brushes is simultaneously effected by means of a hand wheel. Rising from each dynamo are spiralled cables, which pass along the ceiling to the switchboard. This is of marble, framed in mahogany. At the base of the board are the three hand wheels which operate the contact arms passing over the clips of the field regulators standing on the floor behind it. Above these are the three dynamo switches, flanked by the two voltmeter switches, and over these are the five main switches. A Weston illuminated dial voltmeter stands on each side of the board, and three 450-ampere ammeters are arranged in a line along the upper portion. The vessel is wired throughout on the two-wire system.

On each side and back of the switchboard is a 10 h. p. Sturtevant blower, each directly driven by its own vertical engine. The dynamo room is lighted by four three-light electroliers and several lamps fixed in the ceiling.

From the switchboard run five feeders to the main deck. At four points of the vessel risers mount to the upper decks. These are connected to the circulating mains, one of which is on each deck, by means of four centre of distribution safety fuse holders to each circulating main. At six points in each circulating main, whence the smaller wires branch off to the state-rooms, saloons and dining-rooms, are set marble panel cutout boards. These panel boards are of special design, and each has its own peculiar form to fit into the position where it could most conveniently be placed. They are fitted with knife blade switches, which bring the current to two pair of strips of flat copper, between which are set fuse carriers of porcelain. Connection is made behind the board with a snapswitch for almost every circuit. These Hutchinson-Herrick panel boards are handsome and ingenious devices, doing away with a cumbersome system of cutouts. The fuse carrier is a porcelain box, from each side of which projects a small flat copper bar, the inside ends of which have set screws for holding the fuse. The lid is held in place by a pin, and when the carrier is charged it is simply pressed into the clips fastened to the upright strips which run the length of the board. There are 25 of these panel boards. Those on the saloon and gallery decks are set in the transoms of the doors of the passages, those in the dining-room under two of the sideboards, that in the engine room facing the engines, and the others in places where it is most convenient. The two largest are that in the engine room with 24 circuits, and that on the gallery deck controlling the lighting of the dome, which has also 24 circuits.

All the wiring appliances used are those which have been devised by the General Electric Company to meet Government requirements. All the junction boxes, switches, cutout boxes used in the deck and exposed wiring are absolutely watertight, and are all finished like the lanterns, in black. In all parts of the vessel where the wiring might be exposed to moisture, the wire is lead covered, and all the



PLAN OF FEEDERS AND MAINS.

wire larger than No. 6 B. & S. is stranded. Forty-five miles of wire in all is used in the vessel, and in accordance with American marine practice wires are used for the return. The wire used is a special white core marine wire manufactured by the General Electric Company and conforming to Government specifications. The lights are so divided that ten in each circuit is the limit. A series of charts showing the location of each circuit, each light and each appliance, is hung in the engine room, so that the electrician's liability to error may be almost entirely prevented.

The entire electrical equipment was furnished and installed by the General Electric Company, while every one of the lighting fixtures, from the most artistic to the most simple, was designed and made by the General Fixture Company, of New York.

Exception should be made of the 364 electric call bells, 610 automatic fire alarms, and the watchmen's clocks, which were put in by the American Fire Alarm Company, of Boston.

The Priscilla cost a million and a half, is licensed to carry 1,500 passengers and 35 car loads of freight. She makes the trip between New York and Fall River in ten hours, and burns 50 tons of coal a night. She has a crew of 206 men, and to effect a complete circuit of the vessel one and one-eighth miles would have to be covered. She is commanded by Capt. Abram G. Simmons.

Polyphase Transformations.

BY G. M. WARNER.

There have been lately several methods of transforming multiphase currents into single phase currents advanced, purporting to tax equally the several phases of the system, and, perhaps, a few figures on the subject may not be amiss.

Let us investigate a quarter phase system: Assuming our E. M. Fs. and currents to vary according to a curve of sines, we may represent them by $a \sin x$ and $b \sin x$ in one phase and $a \sin (x + 90)$ and $b \sin (x + 90)$ in the other, when working on non-inductive loads.

The power of these circuits would be $(a \sin x)(b \sin x) = a\,b \sin^2 x$ and $(a \sin \{x + 90\})(b \sin \{x + 90\}) = a\,b \cos^2 x$, adding gives $a\,b(\sin^2 x + \cos^2 x) = a\,b =$ a constant; that is, the total flow of energy in the system is a constant.

If the currents in each phase lag behind their respective E. M. Fs. 45°, we would have

$$(a \sin x)(b \sin \{x + 45\}) = (a \sin x)\frac{b}{\sqrt{2}}(\sin x + \cos x$$

and

$$= \frac{a\,b}{\sqrt{2}} \sin^2 x + \frac{a\,b}{\sqrt{2}} \sin x \cos x$$

$$(a \sin \{x + 90\}) \times (b \sin [\{x + 90\} + 45])$$

$$= (a \cos x)\frac{b}{\sqrt{2}}(\sin (x + 90) + \cos (x + 90)$$

$$= \frac{a\,b}{\sqrt{2}}(\cos^2 x - \frac{a\,b}{\sqrt{2}} \sin x \cos x,$$

adding, we get $\frac{a\,b}{\sqrt{2}}(\sin^2 x + \cos^2 x) = \frac{a\,b}{\sqrt{2}}$ and still a constant.

This is true of any multiphase system of circuits equal in every respect.

Now we will look at the single phase system with E.M.F. $c \sin x$ and current, in same phase, $d \sin x$; the power would be $(c \sin x)(d \sin x) = c\,d \sin^2 x$, or no longer a constant, but rather varies from zero to twice its average twice in one cycle.

The same is true if the current lags behind its E. M. F.

From this, it would seem that it would be impossible to transform from one system to the other by static transformers, for in the primary we would have a constant flow of energy, and in the secondary a variable flow, hence the transformer would have to store up energy at times.

Any storage of energy by magnetic means has as yet been very inefficient, and the only recourse has been to a heavy rotating part.

Taking up the method of winding the primary with two circuits, one in each phase, and taking off only one secondary, obtaining thus a single phase current.

While I grant that if we are feeding a non-inductive load both of the phases will be equally loaded, I do not agree that the effect on the generator will be the same.

In a winding, as above, I believe the currents in the two phases are in the same phase—that is, in one circuit the current lags 45° behind the E. M. F., while in the other the current is in advance of its E. M. F. by 45°, and in proof we have

$$[a \sin (x + 45)][b \sin x] = \left(\frac{a}{\sqrt{2}} \sin x + \frac{a}{\sqrt{2}} \cos x\right) b \sin x$$

$$= \frac{a\,b \sin^2 x}{\sqrt{2}} + \frac{a\,b}{\sqrt{2}} \sin x \cos x$$

and

$$[a \sin (x - 45)][b \sin x] = \frac{a\,b \sin^2 x}{\sqrt{2}} - \frac{a\,b}{\sqrt{2}} \sin x \cos x,$$

adding we have

$$\sqrt{2}\,a\,b \sin^2 x = \text{a constant times } \sin^2 x \text{ or the same as a single phase circuit.}$$

It will be noticed that the E. M. Fs. $a \sin (x + 45)$, and $a \sin (x - 45)$ are 90° apart in phase, giving the quarter phase distribution, and the current $b \sin x$ lags 45° behind one, and precedes the other by 45°.

This angular difference being the same in both circuits, the power will also be the same; but this should be noticed, one has a powerfully "inductive" load, while the other is feeding an equal "capacity" load, tending to unbalance the armature reaction in the dynamo

Supposing in addition each phase is loaded with an equal load which is inductive, causing a lag of 45°, then in circuit No. 1 we have two equal currents, each differing from the E. M. F. by 45° lag, while in the other we have two currents, one lagging 45°, while the other is in advance 45°.

The effect of this would be that in one circuit we would have a current equal to 2, while in the other a current equal to $\sqrt{2}$, which, though equally loading the two phases, would not necessarily equally effect the regulation of the dynamo.

Invention of the Telegraph.

In a communication under this head, which appeared in The Electrical World of July 7, an unfortunate typographical error occurred which changed the author's meaning. In the second paragraph of the second column, instead of reading "Alfred Vail sought in court to obtain the justice which he knew was due him," it should have read "Alfred Vail sought no court to obtain the justice which he knew was due him." In the first line of the following paragraph the word "evening" should be substituted by "morning."

Amateur Motor Building.—II.

BY G. E. DUNTON.

The armature and fields of the motor whose mechanical construction was described in the previous issue will be wound for a compound high-speed machine of 55 volts, to be used on an incandescent circuit, and without a rheostat. This machine may be used for either a higher or a lower potential or to run on a battery current by merely changing the gauge and number of turns of wire on both field and armature. As the potential grows higher more turns of finer wire are needed, there being, of course, certain limitations which enter as to speed and regulation. As the potential decreases the volume of current may be safely increased, fewer turns of coarser wire being used and the field wound in series with the armature, using a wire four times larger than the armature wire. The field core must be carefully taped between the sections of lagging, winding the tape, on up through the inside and around down the outside the length of the core. The edge of each layer should

Fig. 21 Fig. 20 Fig. 22

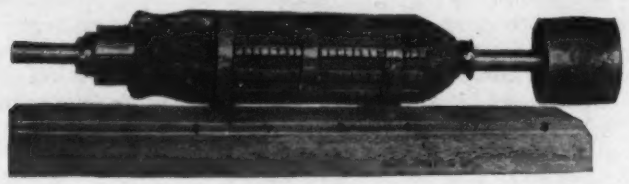
DETAILS OF ARMATURE WINDING.

overlap the one before it about half its width; this will give really two thicknesses of tape, which will be sufficient. Thin Kerite or Okonite tape is the best. In winding the field coils, a wooden shuttle one foot long, shaped so that it will pass through between the pole pieces easily, will be needed. Make this of three strips cut from a cigar box, rounding off the ends and sides and making the capacity for holding wire as great as possible. (See Fig. 19.)

The theory and practice of electrical construction requires so much exercise of judgment that it makes it impossible for the beginner to attain the result he desires by theoretical methods. In designing a motor to run on a circuit in multiple arc without a rheostat, it will be found almost impossible for the amateur to figure out the exact gauge and amount of wire to use and attain the result desired and expected. Taking the model as a guide to follow and using the amounts and gauges the same results should be attained. The compound wound, so-called "self regulating" motor has two distinct and separate coils wound upon its fields; one, called the series coil, has few turns of coarse or low resistance wire carrying the whole current and is in series with the armature; the other, called the shunt, consists of many turns of fine wire of high resistance, and is connected across the circuit in parallel, or in multiple, with the armature, carrying a small portion of the whole current.

Contrary to usual custom, the field will first be wound and the series coils put inside next to the core. About one-half pound of No. 22 B. & S. double cotton covered, and one pound of No. 28 copper wire will be needed; this will allow something extra in case of accident. If a compound known to electricians as insulac can be procured, purchase one pint; if not, get some good clear orange shellac and a small, flat, soft brush. Carefully wind the No. 22 wire on the shuttle ready for use. Paint the end of the wire for about one inch with asphaltum varnish or some quick black drier. Begin from the front or commutator end of the top side of the

core to wind, leaving about eight inches of wire which twist loosely around the long bearing stud on the left side of the core; pass the shuttle down through between the pole pieces from the front to the back, around the end and up on the outside, laying the wire down close to the top side of the wide wooden lagging on the left hand side of the core. Pass the shuttle down between the pole-pieces again, laying the second strand snug beside the first one, and continue around and around, winding slowly and laying the strands snug and even until the narrow or top lagging is reached; the last strand should lay right in snug to this, go around on the inside of



The Armature.

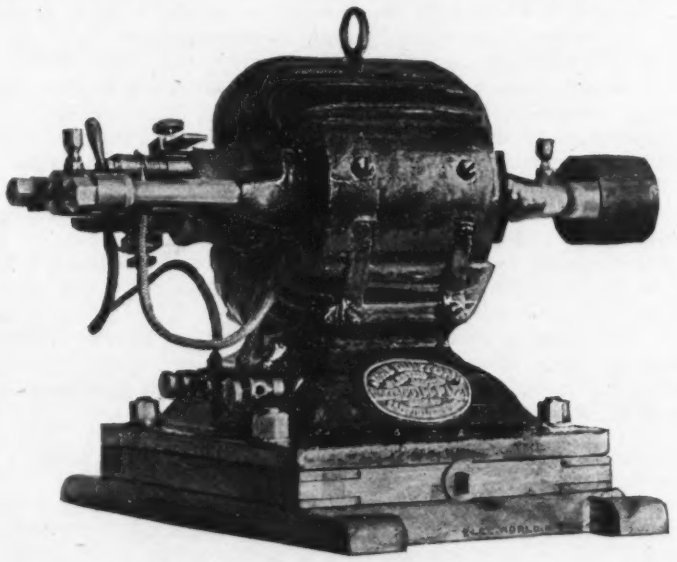
the core, and the next time the wire comes around on the outside it should be on the other side of this lag. Continue the winding until the wide lag is reached on the other side of the core. Then the layer, inside and out, should be given a good coat of the insulac, and another layer may then be wound on over it, back to the starting point and insulaced. The end of the wire may now be cut, leaving about eight inches spare and twisted around the stud on the pulley end. Do not paint this end, as the first was painted simply to make a distinction between the two. In winding on the other series coil proceed in just the same way, starting on the opposite side of the core, not next to the other side of the same wide lag the coil just wound was started beside, but the other lag on the opposite side of the core. It should be wound precisely like the one just put on, having the same numbers of layers and turns of wire. In winding on both the series and shunt coils, the shuttle should pass between the pole pieces always from the front side. Now wind a layer of tape around and completely cover both these coils, proceeding in just the same way as in taping the bare core. The remaining wire on the shuttle should be taken off and carefully coiled, or better reeled, and put away.

About four ounces of the No. 28 wire should now be wound on the shuttle and the winding of the shunt coils begun in the same places and proceeded with in exactly the same manner as with the series coils, laying on eight layers carefully and smoothly. It will be found rather trying to lay this fine wire on smooth and even with a shuttle at first starting, but it will go all right after a little has been wound; each layer should be painted with insulac. If shellac has been used the whole coil should be placed in some gentle heat and thoroughly dried out before any current is put through the wires.

There will be now four ends of wire on each side of the coil, two coming from each end of the core. Untwist all the ends from the studs and bring them up into the middle of the coil, so that the front and back ends will meet. On the coil first wound, the ends will be found to be on the upper side of the lagging, whereas they should to connect come up on the under side. Take the wood off and cut a groove across the inside large enough to allow the four wires to lay in; a piece of asbestos paper and tape should then be laid over the iron core where these wires will cross it, it being best to cut the paper the size of the lag. The wires should never be allowed to touch the iron at any spot, and should be taped where they cross under the wood, so as not to touch each other. Care is necessary in handling these ends not to break them off. Bring the four ends across under the groove and screw the lag back in place, being careful not to jam any of the coil wires or break the insulation in any place; the coils can now be placed aside to dry out.

To get the armature ready to wind, cut two washers from thick asbestos paper, or, better, a piece of the so-called "leather board" used by printers; make the washers one inch in diameter with a five-sixteenths of an inch hole and slip one on over each end of the shaft, bringing it up close to the end of the armature core. Cut off a piece of tape about one foot long and split it up and down through the middle, making two pieces. Wrap a piece around the shaft, beginning snug up against the collar (leather board), and extend out on the shaft about three-fourths of an inch on each end, letting the edges overlap. Cut from the same board twelve strips nine-sixteenths of an inch wide and three and one-quarter inches long; divide the width of each one into thirds and crease up and down its length on the marks with a knife point but do not cut in much, if any. This is done to let the sides bend up nicely and evenly. The sides are then bent up on all the strips, making twelve little troughs, which should be slipped down into the grooves in the armature core. The ends will protrude a trifle beyond the ends of the armature core, but should not be cut off but the bottom bent down so that it just laps over the end washer, and the sides will cover the corners of the projecting tooth of the core.

The armature, with a dog on the pulley end of the shaft, should be placed in the lathe with the commutator end toward the tail stock. Take the belt off and turn by hand, taking hold of the face plate; it will only have to be moved through half a revolution and back. There are many systems of winding, but in this case the Hefner-Alteneck system offers advantages to the beginner for armatures with even coils, so it will be adopted. There are twelve grooves in the core, but as one coil of wire will wind through two grooves, this only gives six complete coils or loops of wire, and as the ending wire of one coil connects up with the beginning wire of the next coil, this would give only six connecting wires to go to the commutator and there are twelve bars; besides, these wires are all on one side of the coil. This is balanced, however, by what is called splitting the coils. Only half of the total number of layers is wound at this first winding, the second half or second set being wound on over the first ones, starting them on the other side of the armature, which gives twelve connections, extending completely around the armature. With the remainder of the No. 28 wire wound on a reel suspended over the lathe and turning freely, the beginner stands in front of the lathe, taking the wire in his right hand and grasping the face plate with the left, and commences to wind. Many winders stand on the back side, but the writer thinks it easier to work from the front; the result, however, is the same. The end of the wire should be painted black, and about three inches of the end left sticking out, which may be bent round into the next groove temporarily. Commencing on the top side and in, at the commutator end, call the groove number one; wind the wire down through groove number one, over the pulley end of the core; turn the face plate from you, from left to right, and bring the wire back through the oppposite groove, or number seven; pull the face plate toward you and bring the wire up over the front end of the core, down through the first groove again, laying the second wire close beside the first strand, over the back end, through groove number seven, and so on until eight strands have been wound in,



The Completed Motor.

which will just cover the bottom of the groove. The layer and the ends of the wire must be shellaced. In crossing the heads it will be better to let the first four strands cross each head on one side of the shaft, and the remaining four on the other side; this will make the heads more even. Now the second layer may be wound on over the first and shellaced, the third over the second, and the fourth over this, shellacing each one. Fig. 20 shows the first layer of this coil wound in place. The end of the wire should be cut off, leaving four inches to spare, which should be brought across the end and twisted up temporarily with the beginning end, but not painted. The second coil should be begun in groove number two, and wound through that and groove number eight; shellac each layer and cut and twist up the ends precisely as with the first coil. Wind in four more coils in exactly the same way; when these are wound in it will be seen that the twelve grooves are half filled with wire, and the ends come out of grooves number one, two, three, four, five

and six. Now six more coils of four layers each will be wound directly over and on top of the first ones. The first coil in this second layer, or set, of coils will commence in groove number seven, and the other side of it will lay in groove number one, in which the first coil was started. It will now be seen at a glance how nicely the windings will come out. The next coil starts in number eight and winds around into number two, the next in number nine, and so on until all are wound in. Figs. 21 and 22 show the armature head with the first six coils and the whole number wound in. The ends that were twisted up merely as a convenience, and to prevent them from being broken, should now be untwisted and straightened out nicely. Take the plain, unpainted end of the first or number one coil and twist it up with the painted end of coil number two; the unpainted end of coil number two and twist it up with the painted end of coil number three; the unpainted end of coil number three and twist with the painted end of the fourth coil, and so around the whole armature. This connects the ending of one coil to the beginning of the next, forming the wire into one great loop over three hundred feet long. The ends are twisted permanently this time, and moderately tight up to the coils, where they come out of the armature.

We must now determine which way our motor armature is going to run, which, like the model, we will suppose to be from right to left, or in the opposite direction from that of the hands of a clock. The commutator should have a so-called "lead" of one bar in the direction which it shall run, in this case to the left.

In connecting the armature wires to the bars, bring the end out, and instead of connecting it to the bar directly in front of the coil, carry the wire over to the next bar to the left; cut the ends off, leaving a little more than is actually needed to solder into the bar-lug. Scrape the insulation carefully off the ends, and bring the two wires down into the little slot sawed in the lug, and solder firmly. Each end of the two wires should be brought to its respective bar and soldered into the slot in the lug. A neat little hood of thin linen should be made to draw on over these connections. It should be turned wrong side out, and the smaller end put on over the commutator lugs and bound down into the groove cut around them with thread; then it may be drawn on over itself, turned right side out and pulled up over the armature, being held in place under the end armature binder. The superfluous ends of the connecting wires protruding from the side of the lugs should be trimmed off nicely. Put a strip of thin asbestos paper around in each of the grooves turned around the armature, and over this wind on eight turns of No. 26 brass spring wire and solder it in at least six places. Trim the extra solder off smooth, and do not allow the binders to set out beyond the armature core. Cut away any tape left on the shaft on the pulley end, and put on a brass collar to prevent the wire from hitting on the end of the bearing. Set the collar with a small screw.

The armature is now complete, and should be placed in some gentle heat, to thoroughly dry out all the moisture before any current is put through the wires. If shellac is used this drying process should be continued for at least twenty-four hours. The field coils may now be connected up, and the finishing touches put on. Two small binding posts, and four 6-32 brass machine screws, three-quarters of an inch long, with four little brass set nuts, two on each, will be needed, and can be purchased at any electrical supply store. The screws go in the two middle holes, and the binding posts go in the end holes in the piece of fibre set into the base.

As the armature is to run from right to left, a north pole must be created in the left hand pole piece, and a south pole in the right hand. The builder should learn Ampere's law for the creation of magnetic poles, which is very simple, and is given in most of the electrical books for beginners; he will then understand why he makes the following connections. Untwist the ends of the field coil wires and bring them all down well under the lower coil, almost to the middle, or within a quarter of an inch of the narrow bottom lagging. A piece of tape should be put in between them and the coil wires they cross over. Take the shunt or fine wires first, and bring the painted or starting end wires of each coil together across the narrow bottom lagging, cutting a little groove across it for the wire to lay in; scrape the insulation off the wires where they cross, twist them up tight, solder and snip off the ends. A piece of tape should be put in under this wire. Now the coils should be taped over by winding on two layers, equalling four thicknesses, in the same manner as in taping the core, covering over the narrow top and bottom lags, but not the side lags. The wire ends should come through the tape near the centre of the bottom side. The top part of the base casting should be chipped out to fit up to the curve of the under side of the field, so that it rests firmly, and held in place by the four brass straps, two of which are shown in the picture of the finished motor. Put in a couple of thicknesses of asbestos paper between the iron and the field coil.

To complete connecting up, take the unpainted ends of the series coil wires (the larger ones), scrape the insulation off nearly to the core, say to within one inch of it, and solder the ends to the binding post screws. Do not draw the wires tight, but leave quite a sag, and slip on a piece of soft rubber tube over each before soldering. The left wire goes to the left hand binding post screw, the right to the right hand binding post screw. The painted or beginning ends of the series coils, and the unpainted or ending ends of the shunt coils, should be joined to each other and to the brushes. Take those on the left hand side first; scrape off the insulation of the series and shunt wires, twist together tight and solder; slip on over a piece of soft rubber tube and again solder to the end of the screw holding the cable going to the lower brush. The two corresponding wires on the right hand side should be treated in the same way, and the ends soldered to the end of the screw holding the cable going to the top brush.

The motor is now practically completed, and may be tested on any direct current of from fifty to fifty-five volts, and will work all right if these instructions have been carefully followed. The painting may be done to suit the builder; the model illustrated was given four coats of blue black enamel and then baked. The supply of current may be taken from any lamp socket by using a plug, screwing in to the socket in place of a lamp, with cord attached. It makes no difference at which binding post the current enters, the result being the same. The motor just described is no toy, but a powerful and practical machine, developing on a fifty-five volt current a power of over an eighth of a horse-power, though considerably less than half the size of any of the one-eighth horse-power motors now on the market. In belting from the motor, connect to as large a pulley as possible and practical, and use a heavy duck tape, one inch wide, such as printers use on their large presses.

This motor is of the style known as the two-pole, double-magnet type, and the model weighs nine and three-quarters pounds. The builder may enlarge this motor, keeping the proportions in a relative ratio and make a much heavier field core, having it cast from steel, thus making a much more powerful machine. The pole pieces can then be cast in one piece with the field core. In building any larger motors, the writer advises, if they are to be run in multiple, that a rheostat, or a starting box be used, placed in series with the armature, even if the motor is self-regulating.

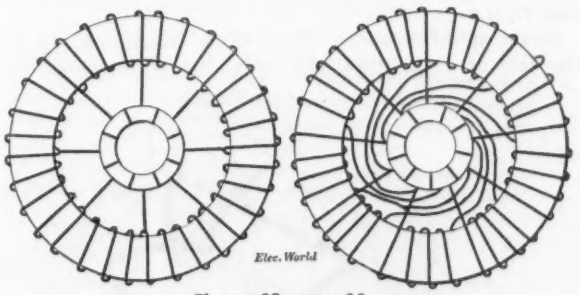
Practical Notes on Dynamo Calculation.—XI.

BY ALFRED E. WIENER.

25. Types of Armature Winding.

a. Closed Coil Winding and Open Coil Winding.

If, in a continuous current dynamo, the reversal of the current would take place in all the conductors at once, considerable fluctuation of the E. M. F. would be the result. In order to obtain a



FIGS. 32 AND 33.

steady current, the armature conductors are, therefore, to be so arranged, relative to the poles, that a portion of them is in the strongest part of the field, while others are exposed to a weaker field, and some even are in the neutral position.

After having thus arranged the conductors, their connecting can be effected by one of the following two methods:

I. All conductors are connected among each other so as to form an endless winding, closed in itself, and consisting of two or more

*ERRATA.—In section 24, page 58, of the last issue, the simplified form of the attraction formula in G. C. S. units should read $= G' \times \frac{\mathfrak{C}_1^2}{16\,\pi}$; in formula (60), same page, the term $\left(\frac{\mathfrak{C}_1'}{6.45}\right)^2$ should be replaced by $\left(\frac{\mathfrak{C}_1}{6.45}\right)^2$; Figs 22 and 24, same page, should be exchanged; Fig. 22 is intended for a horizontal machine and should be in a horizontal position, in place of Fig. 24, and vice versa.

parallel branches, in each of which all the single E. M. F's. induced have the same direction, and in which the reversal of the current occurs in such conductors only that at the time are in the

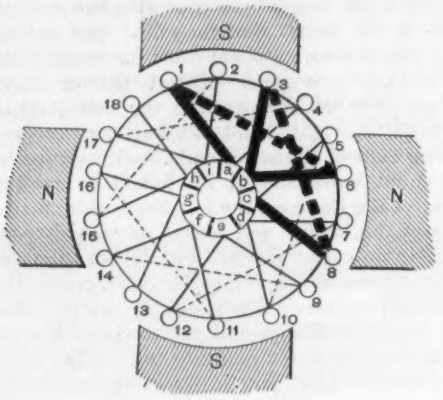


FIG. 34

neutral position. An armature with such connections is called a "closed coil armature."

II. The conductors are joined into groups, each group containing all such conductors in series which, relative to the field, have exactly the same position; and the current is taken off from such groups only which at the time have the maximum, or nearly the maximum, E. M. F., all other groups being at that time cut out altogether. An armature wound in this manner is styled an "open coil armature."

b. Spiral Winding, Lap Winding and Wave Winding.

According to the manner in which the connecting of the con-

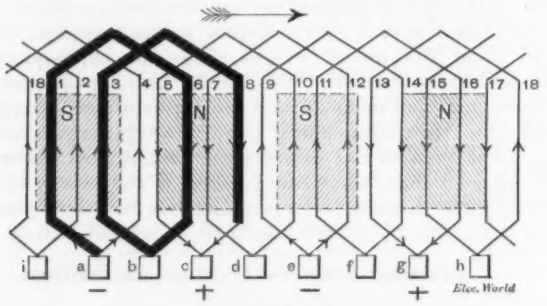


FIG. 35.

ductors by the above two methods is performed, the following types of armature windings can be distinguished: (1) Spiral winding, or ring winding, Figs. 32 and 33; (2) lap winding, or loop winding, Figs. 34 and 35; (3) wave winding, or zigzag winding, Figs. 36 and 37.

In the spiral winding, Figs. 32 and 33, which can be applied in the case of ring armatures only, the connecting conductors are

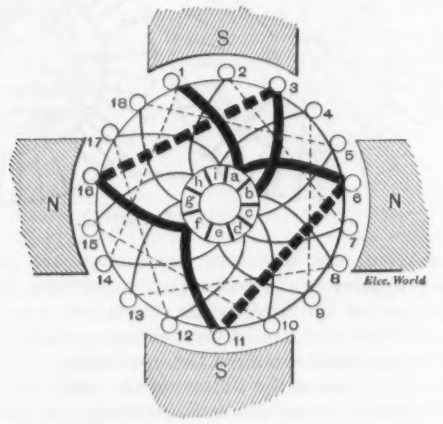


FIG. 36.

carried through the interior of the ring core, and the winding thus constitutes either one continuous spiral, Fig. 32, from which, at equal intervals, branch connections are led to the commutator—or a set of independent spirals, Fig. 33, which are separately connected to the commutator.

The lap winding, as well as the wave winding, is executed entirely exterior to the core, and can be applied to both drum and ring armatures.

In the lap winding, Figs. 34 and 35, the end of each coil, consisting of two or more conductors situated in fields of opposite polarity, is connected through a commutator segment to the beginning of a coil lying within the arc embraced by the former. With reference to the direction of connecting, therefore, the beginning of every following coil lies back of the end of the foregoing, and

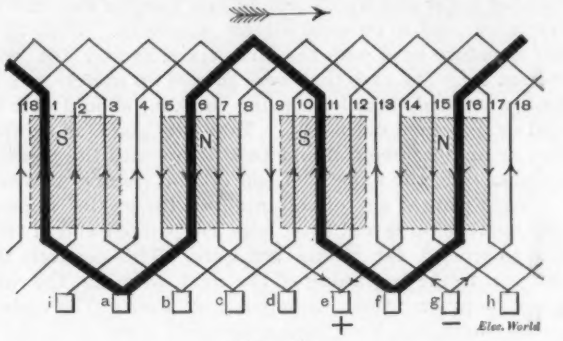


FIG. 37.

the winding, consequently, forms a series of loops, which overlap each other. Fig. 34 represents such a lap winding for a four-pole drum armature, the development of which, Fig. 35, more clearly shows the forming of the loops and the manner of their overlapping.

In the wave winding, Figs. 36 and 37, the connecting continually advances in one direction, the end of each coil being connected to the beginning of the one having a corresponding position under the next magnet pole; and the winding, in consequence, represents itself in a zigzag, or wave shape. The wave winding is illustrated in Fig. 36, and for better comparison the same four-pole drum armature is chosen that in Fig. 34, is shown with a lap winding. The development given in Fig. 37 distinctly shows the zigzag form of the wave winding.

In multipolar machines, the wave winding can be used for series as well as for parallel connection; the lap winding, however, for parallel grouping only.

While the lap winding necessitates as many sets of brushes as

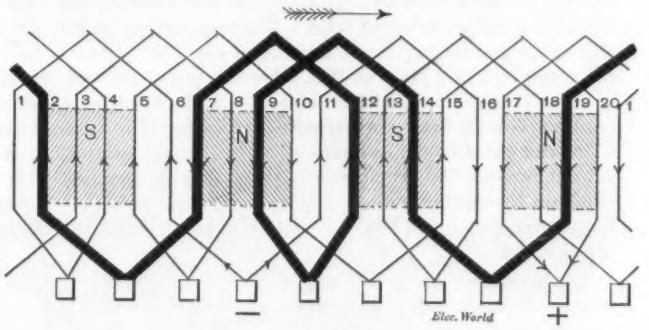


FIG. 38.

there are magnet poles, the wave winding for any number of poles invariably needs but two sets of brushes.

For series-parallel connection, either wave winding may be used or lap and wave windings may be combined. Fig. 38 represents the development of such a "mixed winding," the coils partly being connected in the lap and partly in the wave fashion. This winding, like the wave winding, has the peculiarity of requiring but two sets of brushes, independently of the number of magnet poles.

(To be continued.)

Death of Edmond Julien.

Edmond Julien, the distinguished engineer and founder of what is known in this country and Europe as the Julien system, expired at his home in Brussels on the 5th day of this month. Mr. Julien was born at Ardenne, on the 31st day of August, 1838. He was by profession a civil engineer, and in that capacity built a number of railroads in Russia and Spain. He had the reputation of being of the first rank as a railroad engineer. He amassed considerable wealth in railroad building, and embarked almost all of it in the storage battery business, in connection with Faure and Phillipart. He built what was probably the first storage battery factory in Europe, at Brussels, and in 1885 his storage battery car took the first prize in mechanical traction at the Antwerp Exposition. Mr. Julien was highly esteemed by his fellow citizens at Brussels, and King Leopold knighted him in 1889. He was a man of most imposing appearance, being nearly 6 feet 4 inches in height, and of splendid proportions.

THE ELECTRICAL WORLD'S DIGEST

OF CURRENT TECHNICAL ELECTRICAL LITERATURE

COMPILED FROM PRINCIPAL FOREIGN ELECTRICAL JOURNALS BY CARL HERING

ELEC. WORLD, N.Y.

ELECTRO-PHYSICS.

Phosphorescence at Low Temperature.—According to the Lond. "Elec." and "Elec. Eng.," July 6, Prof. Dewar, in his experiments with temperatures of 180 degrees C below zero, found that although chemical action almost ceases, photographic action does not, but is diminished by 80 per cent.; gelatine, celluloid and other substances were very luminous when exposed for a second to the beam of a strong electric light; from his experiments he is led to the generalization that the more complex a body is in structure the more likely it is to phosphoresce; pure water is weakly phosphorescent, but if very sightly impure it becomes strongly so; phosphorescence is due to some kind of molecular change in the oxygen, which is demonstrated by the fact that ozone is formed during the process.

Nature of Electric Conductivity.—In a paper by Mr. Vaschy from "Comptes Rendus," vol. 118, p. 1,324, abstracted in "La Lum. Elec.," June 30, he points out that electric conductivity appears to be a tendency of the electric field established in a body to dissipate in a greater or less time; magnetic conductivity does not exist, as a field once created is permanent, thus forming a characteristic difference between the properties of electric and magnetic forms of energy.

Analyzing Periodic Functions.—A number of instruments for performing such analysis are described and illustrated by Mr. Hess in "La Lum. Elec.," June 23.

Influence of Pressure on the Dielectric Constant.—A paper by Mr. Roentgen from "Wied. Ann.," vol. 52, p. 592, is abstracted in "La Lum. Elec.," June 23.

Afterglow in Geissler Tubes.—The article abstracted in the Digest, June 23, is abstracted at greater length in the "Elek. Zeit.," June 28.

The Work of Hertz.—The Lond. "Elec.," July 6, publishes some corrections and explanations by Dr. Oliver Lodge, in connection with his recent lecture, which was referred to recently in these columns.

Vortex Theory of Electro-dynamics.—The article by Mr. Blondin is continued in "La Lum. Elec.," June 23 and 30.

MAGNETISM.

Magnetic Lag.—In a paper by Prof. Dechant, abstracted in the "Zeit. fuer Elek.," April 15 (just received), he discusses the lag in the propagation of magnetism generated by currents of different phases encircling a common core; the propagation of the magnetic waves is calculated from the distance between the magnetizing coils divided by the phase difference in seconds; it was found to be 12 metres (per second) with an alternating current of 40 periods, a phase difference of one-third period, and a distance of 10 cm. between the coils; the most sensitive means of showing the existence of these waves was a thin round disc of iron, 0.1 mm. thick; he showed that the rotation of this disc can be explained only by hysteresis; also that the disc also rotated externally to the coils, which is possible only when the diminution in the magnetization along the rod does not follow a geometric progression; with a closed magnetic circuit he showed that this diminution is an important factor in the production of the magnetic lag.

Magnetization of Alloys.—A Royal Society paper on "The Effect of Mechanical Stress and of Magnetization on the Physical Properties of Alloys of Iron and Nickel and Manganese Steel," by Mr. Tomlinson, is published in abstract in the Lond. "Elec.," July 6.

The Effect of Magnetization on the Dimensions of Wires and Rings.—A Royal Society paper by Mr. Bidwell is abstracted in "La Lum. Elec.," June 30.

Magnetization by Rapid Electric Oscillations.—A paper by Mr. Klemencic, on the magnetization of iron and nickel wires, is abstracted in "La Lum. Elec.," June 23.

Magnetization by Hertzian Currents and a Magnetic Dielectric.—The article by Mr. Birkeland from "Comptes Rendus," vol. 118, p. 1,320, is abstracted in "La Lum. Elec.," June 23.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Measuring the Efficiency of a Large Motor.—In a paper by Mr. Rey in the "Bul. Soc. Int." for June, abstracted in "La Lum. Elec." June 16, he describes in detail the testing of a 720 h. p. motor, made for the submarine boat "Gustave-Zédé," by the Hopkinson method; the motor had six poles and two identical armatures, coupled in parallel and keyed to the shaft; these armatures were connected in series and in opposition as in the Hopkinson method. The theory is discussed at some length and the results of the tests given; he deduces two approximate formulas as also the complete formula.

Measuring the Magnetic Qualities of Iron.—A translation of the article by Dr. Koepsel, mentioned in the Digest May 12, is given in abstract in the Lond. "Elec.," July 6, together with the illustrations. In an editorial discussion attention is called to the fact that a small error in B may produce a large variation in the area of the curve, a point which is important in connection with transformers; it is suggested that it might simplify matters to make it a torsional, zero reading instrument, thus doing away with the compensation.

Measuring the Resistance of Electrolytes.—A translation of Prof. Kohlrausch's article, from "Wied. Ann." vol. 51, page 347, is given in "La Lum. Elec.," June 16; several forms of electrodes are described and illustrated for facilitating the determination of the resistance of electrolytes.

Platinized Glass Resistances.—According to the Lond. "Elec.," July 6, Mr. Mergier before the French Physical Society recommends the use of platinized glass for high resistances; a sheet 3 by 4½ inches will give a resistance varying from 25 to 100,000 ohms; they are mounted in a closed bottle containing petroleum and a layer of mercury at the bottom, enabling the resistance to be varied.

Photometric Standard.—In the recent Physical Society paper by Captain Abney, abstracted briefly in the Lond. "Elec.," July 6, he states that from photographs he finds that when used with a slit as a photometric standard the Argand burner is unsuitable, for portions of different luminosity come into view when the slit is approached or receded from; the ordinary fishtail burner was better in this respect.

Pupillometry and Photometry.—Mr. Henry's article is continued in "La Lum. Elec.," June 16, the present portion being devoted to the eye and the pupil. The article appears to be concluded in the issue of June 30.

Resistance of Pure Water.—The article by Profs. Kohlrausch and Heydweiller, abstracted in the Digest June 16, i abstracted in the "Elek. Zeit.," June 28.

Conductivity of Salts in Aethyl and Methyl Alcohol.—An article by Mr. Voelmer is abstracted briefly in the "Elek. Zeit.," June 28.

Physical Quantities.—A paper by Mr. Rovida, summarizing the laws of the actions and the systems of the dimensions of physical quantities, is published in "La Lum. Elec.," June 30.

Electrolytic Meters.—"Ind. and Iron," June 22, publishes an article on this subject, containing, however, nothing new.

DYNAMOS AND MOTORS.

Classification of Dynamos and Transformers.—In a short article by Prof. Blondel, in "La Lum. Elec.," June 16, he points out the importance of more specific and more rational terms in connection with generators and transformers, and suggests the following classification. He divides generators, including alternating as well as continuous, into two classes, those with a discontinuous winding and those with a continuous winding, each class being divided into types with ring, drum or disc armatures and into those with exterior and interior armatures; when machines generate at the same time continuous and alternating currents he recommends the term "polymorphic," suggested by Mr. Hospitalier; the terms "di-alternator and tri-alternator" or "duplex" and "triplex" alternators are suggested when the machines deliver two or three-phase currents. Transforming apparatus he divides into "redressers" (also known as rectifiers); "transformers" which transform by induction a primary into a secondary current of the same nature, divided again into continuous current, simple alternating current and polyphase current

transformers; "converters" for converting by induction a primary into a secondary current of a different nature, divided into rotating converters with continuous current windings and converters with stationary flux ("a flux fixe") such as those of Scott and of Hutin & Leblanc.

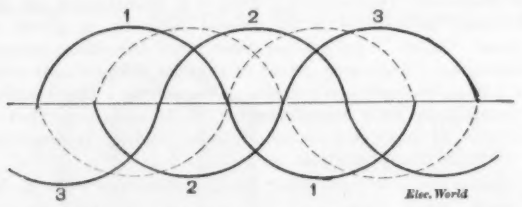
Sine Curve Alternators.—The Lond. "Elec.," July 6, ridicules the practice of some American companies in building true sine curve alternators; "probably an alternator with a true sine curve, even though it may disdain to run in parallel with a machine having a more bactrian characteristic, is little or no better intrinsically in a commercial point of view than a less highly bred article."

New Synchronous Motor.—"La Lum. Elec.," June 23, contains a short description and discussion of the new motor suggested by Prof. Ferraris, mentioned in the Digest, June 16.

Starting Single Phase Motors.—See abstract under "Transforming Single-phase into Three-phase Currents."

TRANSFORMERS.

Transforming Single-phase into Three-phase Currents.—In the "Elek. Zeit.," June 28, Mr. Deri describes the following method. He states that in order to produce a rotating field of the greatest possible effect, the differences in phases must be symmetrical and the maximum values of the currents, and therefore also of the fields, must follow at equal intervals. In the method described by Prof. Ferraris, in which a difference of phase is obtained by a self-induction, he shows that the shifting must always be less than 90 degrees, the closer it is to this value the more will the resistance of the self-induction weaken the current and therefore the field; it is therefore impossible to obtain symmetry by this means in a two-phase system, and the use of condensers with the other current is excluded as they are impracticable and costly; such an arrangement would not produce a continuous rotating field, but a pulsating one. Mr. Deri instead of producing a two-phase current with which to start motors, uses a three-phase current, which he obtains from a single-phase current as follows: In the adjoining figure curve 1 represents the



Transforming Single-Phased into Three-Phased Currents.

original current, curve 3 is a shunt from this in which the phase has been shifted 60 degrees by means of a self-induction; the effect of the intermediate phase, curve 2, is obtained by two equal windings, through one of which current 1 is passed in the reverse direction, and through the other of which current 3 is passed in the reversed direction, as shown by the dotted lines; the combination of the two currents shown in dotted lines is equivalent to the curve 2, shown in full lines; he assumes that the currents follow the sine law; strictly speaking the current 3 is shifted through 60 degrees and the connections reversed, so as to reverse the current, thus producing a shifting of 240 degrees. A simple theoretical deduction is given. In order to meet the condition that the maximum intensities of the fields and the currents 1 and 3 are equal, he either inserts a resistance in one of them, or uses different voltages in the two branches. (Precisely the same invention was described and illustrated under "Alternating Current Motor" in the Digest, Nov. 11, 1893.)

Current-Rushes in Transformers.—Mr. Hay's article, abstracted in the Digest last week, is continued in the Lond. "Elec.," July 6; curves and results are given showing a general agreement between the theoretical and experimental results; for constant permeability, he sums up the knowledge regarding such rushes as follows: (1) "The phenomenon of a 'Current-rush' (accompanied by a corresponding 'rush' of magnetic induction) consists in the appearance, at the instant of closing the circuit, of certain abnormal waves, which gradually become modified so as to assume the normal form. (2) The distortion of the initial waves consists in an enlargement of one set of half-waves, accompanied by a reduction of the other set. As time goes on, the abnormal half-waves diminish in size, and the abnormally small ones increase, until a state of equality is reached, which is the normal state. (3) The current-rush is a function of the resistance and inductance of the circuit; it increases with the latter and diminishes with the former. In no case, however, can it attain the value 2. (4) The change from the abnormal to the normal state takes place comparatively rapidly at first, then more and more slowly. In all cases where there is a considerable rush, an interval of time corresponding to several periods must elapse before an even approximately normal state can be reached. (5) The damping of the abnormal waves is due entirely to the resistance of the circuit." If the circuit could be deprived entirely of resistance, he shows that the waves would preserve their initial type without undergoing any modification, and that they would lie entirely above the time axis, or in other words, a simple harmonic E. M. F. would produce, not an alternating, but a uni-directional fluctuating current, and that the magnetic induction would always be of the same sign; by increasing the time constant, current-rushes can be obtained which do not fall far short of two, and the waves of which will preserve their type for a considerable number of periods.

In the same issue Prof. Fleming calls attention to the fact that he was the first to point out the effect of current-rushes in a paper read in 1892; he believes that Mr. Hay will find that the experimental evidence is not quite in accord with the simple theory which he advances, and that he, Fleming, had abandoned that theory long ago, as it did not explain well ascertained facts.

Transformer Systems.—The Lond. "Elec. Rev.," July 6, contains a communication from Mr. Whitcher, advocating a system in which a third main is used, making two circuits, one of which can be completely cut off during the hours of light load.

ARC AND INCANDESCENT LIGHTS.

Incandescent Lamp.—A long paper by Mr. Larnaude on the present state of its manufacture is published in the "Bul. Soc. Int." for June, a long abstract being reprinted in "L'Ind. Elec.," June 25. The article is interesting reading, but contains little that is new; he points out the advantages in forcing the lamps, stating that at the present low price of the lamps it is more economical to force them and replace them more frequently; curves are given showing the variation in the candle power for a range of 20 volts on each side of the normal; also the efficiencies in watts per candle. From some experiments of which he gives the results, he shows that the loss in the light of a lamp after it has been run for some time is due about equally to the consumption of the filament and to the blackening of the bulb; in these experiments the bulbs were cleaned by admitting the air to the blackened bulb, the bulb being then heated to a nearly red heat, which causes the carbon deposit to disappear, after which the lamp was again sealed, the air exhausted, and the test made. He speaks of the advantages and disadvantages of using metallic oxides in place of the carbon for the filament, suggesting that some such material as silicide of carbon might be used, stating that the recent experiments of Mr. Moissan have shown that this material could probably be manufactured without the same difficulty as heretofore. He gives the temperature of volatilization of carbon as 1,700 degrees C, stating that incandescent lamps must be run below this temperature. He speaks favorably of a process of making the filament, which he describes, in which a plastic carbon mixture is pressed out in the form of wires through dies. In comparing the cost of the light from an arc and an incandescent light, each of 500 candles, he concludes that the cost of the latter is twice as great.

Electric Light in Warfare.—According to the Lond. "Elec. Eng.," July 6, an ingenious device is used in the German army to prevent the enemy from locating the position of the plant used for an electric search light; the light from the projector is thrown on a mirror about 600 feet distant, from which it is reflected to the required point; the mirror is operated by an electric motor, which is controlled from a distance. (The moisture so often found in the atmosphere of Germany, or a small amount of smoke would, however, soon reveal the position of the reflector itself.)

Projectors.—A number of systems are described and well illustrated by Mr. Richard in "La Lum. Elec.," June 23.

TRANSMISSION OF POWER.

A Continuous Alternating Current Transmission System.—Prompted by some comments made in the Digest last year regarding the laboratory nature of the inventions of Messrs. Hutin and Leblanc, Mr. Guilbert publishes in "La Lum. Elec," June 16, a profusely illustrated description of a novel plant which has been in regular operation for several months in transmitting power from La Chapelle to Epinay. In American journals, he states, there is a tendency to publish artistic illustrations of the outside of a machine, which give no idea of its principle or of its operation, while in France it is preferred to give detailed descriptions in an intelligent manner, showing the principle and operation; (these remarks intended presumably as a reply to the comments above referred to, do not, however, meet the case, which referred to practical apparatus as distinguished from mere suggestions). In this plant a low tension, continuous current is converted into a high tension three-phase alternating current by the machine called a "panchahuteur"; these are transmitted over the line and in a similar machine are again transformed down to a continuous low tension current and used for charging accumulators for lighting a railway station; the original continuous current voltage is between 110 and 170, the alternating current voltage is between 4,000 and 5,000, the line currents about 1 ampere, the distance almost 5 miles and the final voltage about the same as the original; the original current is from 60 to 70 amperes, and the final current from 40 to 50; the efficiency of the transmission without considering the line loss is between 75 and 78 per cent. for about 12.5 kilowatts delivered at the farther end; including the line losses, the total efficiency of the plant appears to be about 60 to 68 per cent,; it is believed that by making changes and improvements in the apparatus, the efficiency can be increased to 90 per cent.; the important loss of energy is that in the motors, which can be greatly reduced if desired. The general principle of the transforming machines, which are similar to each other, is that the continuous current is transformed into a tri-phase alternating current by means of a commutator driven by a motor, these currents being then transformed into high tension currents. The article contains 20 illustrations showing the connections in the apparatus, several external views and a number of curves of efficiencies under various conditions. The receiving apparatus is driven by a synchronous motor, absolute synchronism being obtained by a special device; the moving of the brushes for different loads is accomplished automatically and there is said to be no sparking; the motor does not start by itself, but it is said that a few turns by hand are sufficient; even this difficulty however can be overcome; it is believed that the apparatus can be sim-

plified very greatly, this being the first installation; he believes this system can be used with success for considerably increasing the carrying capacity of feeders. Several tables giving quite complete experimental data under various conditions, are included. Regarding Mr. Scott's system for transforming di-phase into tri-phase currents, he believes that too much stress has been put on this invention, stating that the principle is so simple that it is quite probable that it has been indicated before; he explains briefly a solution of the problem by Messrs. Hutin and Leblanc. A short abstract of this article is published in the Lond. "Elec. Eng.," July 6.

Continuous Current Transmission —The installation at Sigmaringen is illustrated and described in the "Elek. Zeit.," June 28. A very brief abstract is given in the Lond. "Elec. Eng.," June 6. Two series dynamos of 90 h. p. are driven by turbines generating a continuous current of 1,100 volts and 61 amperes; they are connected in series but as a precaution a third wire is used, making it a true three-wire system; the arrangements of the switchboard connections are given; the distance is 3 miles, the wires being overhead; at the secondary station the current is transformed by continuous current transformers; the starting is done entirely at the primary station, a shunt to the magnet winding being adjusted after the turbines are started so as to generate a gradually increasing current, the motors beginning to start with a current of 20 amperes and 200 volts; to stop them this operation is reversed. Safety apparatus is provided, there being an automatic current interrupter to provide against open circuits and a field short-circuiting apparatus to provide against short circuits.

ELECTRIC RAILWAYS.

Accumulators in Power Houses.—The interesting railway from Zurich to Hirslanden is described and illustrated in the "Elek. Zeit.," June 28; it is said to be the first railway plant in which accumulators are used at the power houses to equalize the load, and the installation is said to be very successful. The article includes a diagram of the complete connections at the station; the dynamo delivers a current of constant intensity, accumulators being charged or discharged as the load on the line is less or greater than that of the dynamo; by means of automatic arrangements, shown in the diagram, the number of cells at the end of the accumulators is automatically cut into or out of the circuit to keep the voltage constant; the dynamo charges all but the cells at the extreme end, the latter being charged by a separate small dynamo with the aid of an automatic device. Results are given showing that there is a saving due to the use of accumulators of 2.2 lbs. of coal per h. p. hour, amounting to almost a ton of coal a day, representing a saving of about $2,500 a year; the cost of the accumulators with the accompanying apparatus was about $7,400; allowing for interest and repairs of accumulators, it is shown that their cost is saved in about 4 years by the saving of the coal; this saving is due chiefly to the fact that it is not necessary to keep in reserve a second boiler and steam engine, and that by this arrangement the steam engine is running continually at its best efficiency; besides this, the total installation is cheaper than without accumulators, as the latter cost less than the machinery and increased plant which they replace. The present plant contains two main dynamos and engines of 90 h. p. each, one set serving as a reserve.

Accumulator Traction on Ordinary Roads.—"Ind. and Iron," June 15, gives the opinions of several accumulator manufacturers on this subject. Mr. Epstein does not think there is any insuperable objection, stating that he is at present constructing several electric vehicles in the shape of the "Victoria" intended for 4 passengers; the vehicle weighs 1 cwt., accumulator 4, motor of 1.5 h. p., 3 cwt., and 4 passengers at 5.5. making a total of 13.5 cwt.; on account of the dead weight he believes that only small vehicles are practicable. He believes that improvements in accumulators will be made, and states having obtained results which open up great prospects. Mr. Niblett believes that accumulators will have to be greatly improved before such travel becomes practicable; he has very little hope for the efforts that are being made with such vehicles; although only about 4 amperes (presumably ampere hours) per pound are obtained, he believes that 18 to 20 will be attainable; which he bases on his experiments with lithanode plates. He believes that the time is rapidly approaching when every vehicle in the street will be propelled by stored electricity, but states that first the defects in existing accumulators must be removed. Mr. Drake concludes that traction with accumulators on anything but a level is a practicable impossibility, either now or at any future period. The issue of June 22 contains a communication by Mr. Ward, who favors such traction, basing his opinion on practice; he ran the first electrical omnibus in London for over 5 000 miles. The issue of June 29 contains another correspondence by Mr. Niblett.

Electric Railways.—The paper by Mr. Hammond, mentioned in the Digest last week, is published in abstract in the Lond. "Elec. Eng.," July 6. It appears to be made up largely, if not entirely, of information already published; it is discussed unfavorably in the leading editorial of the Lond. "Elec. Rev.," together with several recently established systems of a complicated nature, among them being the Patton system, which is being tried in Chicago.

Heilmann Locomotive.—"La Lum. Elec.," June 16, gives a diagram of the complete connections, and describes an improvement in which it is intended to proportion the power of the steam engine to the variable resistance of the train by exciting the magnets of the generator by a special dynamo run by a separate engine.

The Behr High Speed System.—"La Lum. Elec.," June 16, publishes a number of good illustrations, together with a short description, of the high speed system which is being exploited by Mr. Behr in England; it is a single rail system.

Underground Railway at Budapest.—This underground road is to be laid immediately below the pavement, and is therefore not in the nature of a tunnel road; the contact rail will be fastened along the sides of the road and not between the rails.

CENTRAL STATIONS, PLANTS, SYSTEMS AND APPLIANCES.

Alternating Arc Light Installation.—The installation at Hastings is described briefly in the Lond. "Elec. Rev.," July 6; the lamps are arranged in parallel across the 2,000 volt mains, a small transformer in each lamp performing the necessary conversion; "the lamps may be turned on or off from the central stations by using one return wire only," a further description of which, however, is not given; the difficulty lies in insulating the lamp as a whole.

Plug Switch.—A switch devised by Dr. May, which is said to comply with all the requirements of the German insurance companies, is illustrated and described in the "Elek. Zeit.," June 28.

Gas vs. Steam for Central Stations.—An article in the Lond "Elec. Eng.," July 6, gives the detailed estimates of the prime cost and the cost of operation of a large and a small plant, using in one case steam and in the other a Dowson gas plant, showing a balance in favor of steam in both first cost and cost of operating.

Turbine.—The Seger steam turbine is briefly described and illustrated in "La Lum. Elec.," June 16. According to the issue of June 23, the Oerlikon Company has recently constructed a 5 h. p. Laval turbine dynamo, the speed of which is 30,000, that of the dynamo 3,000, and the steam consumption 36.5 lbs. per h. p. hour.

Petroleum Motors.—A recent set of competitive tests made in Paris with small petroleum motors is mentioned in "La Lum. Elec.," June 16; the highest prize was awarded to the Merlin motor.

WIRES, WIRING AND CONDUITS.

Ship Wiring.—A new system is described in the Lond. "Elec. Rev.," July 6, and termed an almost jointless one; mains are run from a distributing board, from which the whole lighting is manipulated; from there mains are run to small subsidiary boards placed in accessible parts of the ship, each for groups of from 6 to 8 lamps, the switching on and off being usually done from these boards; from these, separate leads run to each lamp, so that the only joints are at the distribution boards. The increased cost is said to be only 10 per cent. of the cost of the wire, which extra cost is said to be compensated for in other ways, among them being the saving in labor in making connections.

Underground Cable for Low Tension Currents.—A new cable of Messrs. Felten and Guillaume, in which the conductor is made in the form of a composite tube, is described and illustrated in "La Lum. Elec.," June 30.

Deflection of Poles for Overhead Lines.—A mathematical article on this subject is published by Mr. Colard in "La Lum. Elec.," June 23.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Telegraph Between Egypt and the Cape.—"La Lum. Elec.," June 30, discusses Mr. Rhodes's proposal to connect Egypt with the Cape by a transcontinental line.

Pacific Cable.—A note regarding the Ottawa Conference is contained in the Lond. "Elec. Eng.," July 6. Several letters from the Canadian Blue Book are published in the same issue.

New Caledonian Cable.—A long illustrated paper by Mr. Reynier giving the history, construction and laying of this cable, is published in the "Bul. Soc. Int." for June.

Automatic Block System.—The Seaton and the Tyer systems are described and illustrated in "La Lum. Elec.," June 23.

ELECTRO-CHEMISTRY.

Primary Batteries for Lighting.—The Barruet system is described and illustrated in "La Lum. Elec.," June 23; it has been in use for several years; the cost per kilowatt is not given; but is admitted to be greater than that obtained with dynamos, but not too great for installations, in which the cost is not the principal consideration; a modified sulphate of copper battery with circulating liquids is used to charge accumulators successively, in groups of two or three, by an automatic apparatus. (In an article in "Ind. and Iron," June 29, the Fulgur battery, quite similar to the above, is briefly described.) The London "Elec. Rev.," July 6, discusses the Fulgur and Barruet primary batteries, expressing its opinion that there is no great future of primary batteries for lighting purposes.

Schoop Accumulator.—Devices for keeping the liquid in constant circulation are illustrated and briefly described in "La Lum. Elec.," June 30.

Minimum E. M. F. of Electrolysis.—A paper by Mr. Noursison is abstracted briefly in the "Elek. Zeit.," June 28; he demonstrates that the minimum E. M. F. for the electrolysis of alkaline salts in solution is constant for all the salts of the same acid; the calculated and observed values are given, the former being: for acid compounds of chlorine, 2.02; bromine, 1.75; iodine, 1.16; sulphate, 2.15; nitrate, 2.07, and chlorate, 2.07.

Electric Tanning.—The Humy system is illustrated in "La Lum. Elec.," June 16; the leather passes between rolls, which act as the electrodes; the electrothermic action of the current facilitates the penetration and subsequent action of the tannin, as also the absorption of the materials intended to increase the weight.

Electric Pickling Bath.—Pickling baths become saturated, thus entailing an expense for renewal; to avoid this Mr. Heathfield, according to "La Lum. Elec.," June 23, uses an electric current in such a bath, the piece to be pickled forming the anode; the acidity of the bath is thus maintained indefinitely.

Brewery Analysis.—An electrical process, which is said to have shown remarkable accuracy, is mentioned in the Lond. "Elec. Rev.," July 6; the amount of invert sugar, which it is very important to determine, is measured by means of a copper solution, the quantitative determination being made by means of electrolysis.

MISCELLANEOUS.

Death by Electricity.—The "Elek. Zeit.," June 28, abstracts a paper read at the recent Medical Congress at Rome. Experiments were made with animals, the current being an alternating one; death resulted mostly by the sudden stopping of respiration, which stoppage caused death by asphyxia; the heart action continues for about two minutes, after which secondary cessation of heart action takes place, causing death; frequently however, breathing started again spontaneously and the animal recovered completely; with a current of 1,500 to 2,000 volts, the killing was not sure and easy; the danger increases in proportion to the higher development of the brain and therefore human beings are more easily affected than animals. Sometimes death takes place suddenly through the instantaneous cessation of heart action; a gradual paralysis of heart action, as noticed in human beings, could not be produced experimentally; in none of these cases was there any anatomical change to which death could be ascribed; in a few cases there was mechanical lesion in the form of a rupture of the blood vessels and internal hemorrhage, in which case the animals died of pressure on the brain after quite a number of hours.

Fatal Accident.—The English journals of July 6 report a fatal accident which occurred at the 10,000 volt mains at the Deptford plant.

Treatment of Trigeminal Neuralgia.—A more or less successful electrical treatment is described in an abstract from the "Lancet" in the Lond. "Elec. Rev.," July 6.

Discovering Flaws in Iron and Steel.—An apparatus is mentioned but not described in "Ind. and Iron," June 29; it appears to consist of small pneumatic tapper, worked by hand, which is made to tap over the piece to be tested; it is in some way connected with a telephone in which a false sound, quite distinguishable from the normal sound, is heard when a spot in the neighborhood of a flaw is reached.

Electric Brake.—A band brake operated by an electromagnet for instantly stopping machinery is mentioned in "La Lum. Elec.," June 16; in case of an accident the workmen in a factory need only break the glass cover of an apparatus in order to stop ordinary machinery in about one second, and the most powerful machinery in from two to three seconds.

Electric Flying Machine.—According to the "Elec. Tech.," June 15, some recent experiments made at the high school at Bruenn, with a small model, proved successful and promising; a double wheel with sails, driven by an electric motor, raises itself and could be propelled horizontally. The same journal states that the 50 foot wheel for the Wellner flying machine has been completed and will soon be used for making tests.

Automatic Steering Compass.—The device mentioned in the Digest June 2 is described in the Lond. "Elec. Eng.," July 6.

Artificial Rain.—According to a quotation from "Comptes Rendus," vol. 117, p. 566, Mr. Baudouin has succeeded in producing rain by conducting the electricity from the clouds by means of a kite.

Fire Damp.—According to "La Lum. Elec.," June 30, Mr. Delaurier, in a note before the French Academy, suggests igniting the fire damp in mines, as quickly as it is produced, by means of electric sparks.

Index to Literature.—According to "La Lum. Elec.," June 16, a publication is to be started in Vienna in July, in the form of a universal index of scientific and technical literature; each number is to contain a list of the periodic publications classified according to subjects and giving the titles, table of contents, subscription price, place of publication, etc.

Entropy.—A statement by Prof. Lodge advocating the conception of entropy to engineers is given in the Lond. "Elec.," July 6.

Biographical.—A translation of the memorial address by Prof. Ebert on "Heinrich Hertz" is published in the Lond. "Elec.," July 6.

The Scenograph.

The scenograph is the latest development of the cycloramic art. It is now on exhibition at the Madison Square Garden, where it is attracting considerable attention by the brilliancy of its effects and the fidelity of its representations. The scene depicted is the World's Fair, and the spectator gazes at the White City from the point of view of the æronaut whose balloon is some 300 feet off shore and 600 feet above the lake.

The view is at night, of course, and every building on the grounds is sparkling with light. Every electrical effect is produced in miniature precisely as the larger real effects were produced at the Fair. Even the McMonnies Fountain is a practical fac-simile of the original. The boat on the lake are independent affairs whose propellers are worked by their own little motors. There is a small search light on the Manufactures Building whose hundred-candle-power light sends its beams into the perspective distance. In the background the Midway Plaisance with the big Ferris wheel is shown. The wheel goes aronud and nearby the captive balloon rises up and down at intervals. One feature of the exhibition is that the modeled and painted houses are geographically correct. It is said that every hotel near the grounds can be pointed out and most of the houses in Chicago are represented, even to the one in which Carter Harrison was shot. On the right, Mackaye's ill-fated Spectatorium is shown, while on the left the moving sidewalk is seen.

The electrical effect is very beautiful. There are 600 16 c. p. lamps in operation besides the myriads of miniature specks of flame which light up the sidewalks. Mr. D. J. Buckley, the electrician, is authority for the statement that there are one thousand separate 122 volt circuits. The McMonnies fountain is done in five colors and even the lighthouse has its revolving lamp just as do its prototypes on a larger scale. The power is supplied from the Madison Square Garden plant.

Everything is built on a scale of one to sixty, and so accurate is the representation that every night people bring with them opera glasses and succeed in pointing out the house, or hotel, in which they stopped while in Chicago. The creator of this exhibition, Mr. E. J. Auston, has been identified for many years with nearly all the principal cycloramas in America, including "The Battle of Gettysburg," "The Chicago Fire," "The Crucifix," etc.

Some Interesting Patents.

The budget of electrical patents issued on July 17 contains an unusual number granted to well-known inventors. The activity in this direction is gratifying, and brings to mind the early days of electrical development.

Prof. Elihu Thomson is represented by a patent for a commutator, in which ready means are provided for renewing the insulation between the

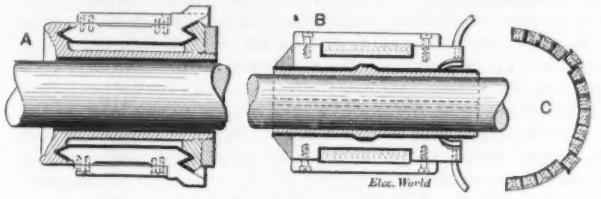


FIG. 1.—RENEWABLE COMMUTATOR.

segments or of correcting the defects in the face of the commutator by removing a few of its segments without turning down the whole commutator. To this end the commutator is divided into a set of sub-segments and a set of wearing or surface segments, upon which the brushes bear and which are insulated from one another. In Fig. 1, A and B show two forms of commutators, the segments in the second case being secured by a binding wire. The manner in which the insulation, which may be of mica or mica paper sheets, is applied is shown in C, the upper half representing all of the segments with insulating material, while in the lower half each alternate segment would be directly attached by screws to the sub-segment without insulation underneath.

A system of electric distribution forms the subject of a patent issued to Prof. Edwin J. Houston, the application for which was filed November

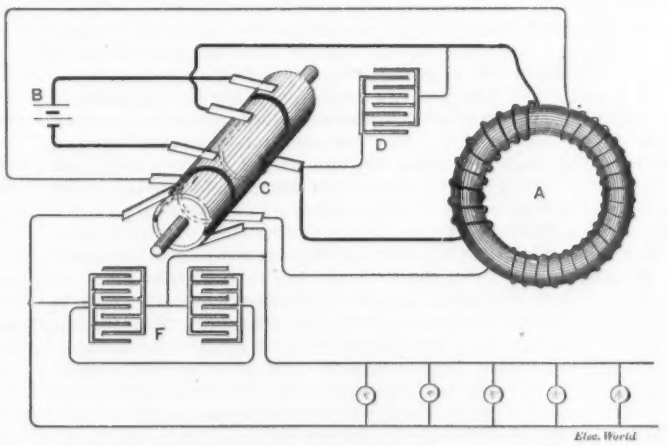


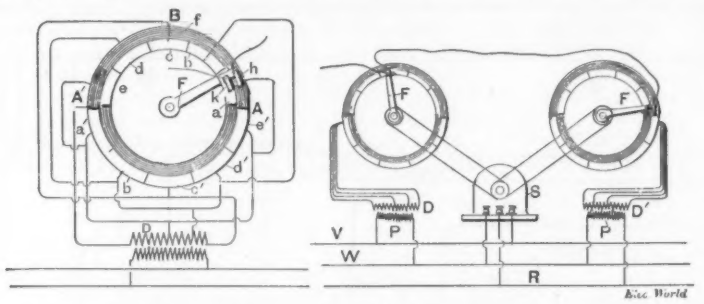
FIG. 2.—CONTINUOUS CURRENT TRANSFORMER.

17, 1887. The object of the invention is to enable electric currents of low E. M. F. to be readily converted into currents of high E. M. F., thus extending the application of those sources of electrical energy which are limited to the generation of low E. M. Fs. The current from a unipolar dynamo electric machine, thermo electric pile, combustion carbon battery, or other source capable of generating electric currents of great quantity but low E. M. F., is passed through the primary of an induction coil of any of the well known forms. This current is caused to vary in intensity or direction by any of the well known methods, such as are employed in connection with induction coils, so as to develop secondary currents of higher E. M. F. in the secondary coils. At the same time the secondary coils of the induction apparatus are provided with a suitable commutator acting in unison with the devices providing changes in the direction or intensity of the primary current, so as to commute or

turn into one and the same direction the high potential alternating currents developed in the induction apparatus. Referring to Fig. 2, A is an induction coil and B is an electric source of low E. M. F.; C is a commutator of any construction suitable for varying, interrupting, changing or reversing the currents from the source B, the source B is placed in a circuit whose terminals are provided with brushes resting on the commutator, as shown, the primary of the induction coil being similarly provided. In order to commute the alternating current thus formed there is in the secondary circuit of the induction coil a third set of brushes, while a fourth set transfers the current to the working circuit. Condensers D and F may be used in the primary and secondary circuits so as to secure greater uniformity in the current.

A patent granted to John F. Kelly, of the Stanley Laboratory Company, relates to a method and apparatus for transforming alternating into continuous currents, and is based upon the fact that if two alternating E. M. Fs. in quadrature be made to vary respectively as the sine squares and the cosine squares of the angle traversed, their sum will always be constant, and therefore produce a undirectional constant current.

If the conductor, D, Fig. 3, in the form of a coil, such as the secondary of a transformer, be divided up into a certain number of sections of proper lengths and a brush caused to travel at a uniform rate in contact



FIGS. 3 AND 4.—APPARATUS FOR TRANSFORMING ALTERNATING INTO CONTINUOUS CURRENTS.

with the terminals of such sections, it is evident that the proportionate part of such conductor included between such brush and a stationary brush connected with one end of the conductor will depend upon the relative lengths of the sections. These sections are proportioned in the following manner: Suppose that there are M sections in the conductor, and that the whole number of turns or length of the conductor, which we will represent by L, be taken as corresponding to the sin $\frac{1}{2}\pi$ or ninety degrees, then the number of turns included in the first section beginning with the largest will be sin $\frac{\pi}{2M} L$ the number included in the first two sections, sin $\frac{2\pi}{2M} L$, in the first three sin $\frac{3\pi}{2M} L$, and so on up to $M-1$ sections, sin $\frac{(M-1)\pi}{2M} L$.

A series of insulated contact plates is provided which are designated by the letters a, b, c, d, e and a′, b′, c′, d′, e′, and a continuous plate f so arranged that two brushes, h, k, making one complete revolution in the time occupied by a complete cycle of the current to be transformed, may be caused to sweep over them, the disposition of the plates being such that during one-half of the cycle of movement one brush, as h, will remain in contact with f, while brush k passes successively over plates a, b, c, d, e, and during the remaining time the brush k remains in contact with f while brush h passes successively over plates a′, b′, c′, d′, e′.

One terminal of the conductor D is connected with plate f and the terminals of the several sections are connected in order to plates a, b, and c. If, therefore, the brush k be caused to traverse in succession the contacts a, b, c in a quarter period, brush h meanwhile remaining on plate f, all of the conductor, D, will have been traversed in that time, the number of turns included in the circuit varying as above described so that the electromotive force between the brushes h and k will be equal, at any instant, to $E \sin^2 2\pi n t$. If the brushes be then moved back the sections of conductor, D, will cut out in reverse order; but this is more readily accomplished by causing the brushes to continue their motion so that brush k passes over plates c, d, e, while brush h remains on plate f, said plates d and e being connected with the sections of D but in the opposite order to a and b, so that a forward motion of brush k from c to e is equivalent to a backward motion from c to a. The two brushes being carried around together, one in contact with the continuous plate f, pass from the point A, when they include no section to B, where they include all the sections of conductor D, and hence to A′, where they again include no section.

At A′ the continuous plate and the sections change places with reference to the brushes, so that the brushes in traveling onward reverse the connections of the conductor with respect to the external circuit.

The order of the plates a′, b′, c′ is also reversed again in the third quadrant so that the last section of D cut out in the second quadrant is the first brought in in the third, and it will be understood that the plates in the third quadrant are connected in the same order as those in the first, while those in the fourth quadrant are connected in the same order as those in the second.

As the pair of brushes are rotated synchronously with the impressed frequency, they will include between them a number of turns substantially proportioned to the sine of the angle of rotation, and as the electromotive force at the terminals of the conductor D is also varying as the sine of the same angle, the electromotive force between the brushes will be substantially proportional to the square of the sine.

A similar conductor, D′, Fig. 4, and a commutator such as described, but with the phase of the electromotive force shifted ninety degrees, will give an electromotive force substantially proportional to the square of the cosine, and if we connect the two sets of brushes so as to superimpose the two electromotive forces their sum will be constant. This is illustrated in Fig. 4, where V, W, indicate the leads from a source of two alternating currents in quadrature and R the common return. P and P′ are the primaries of transformers included in the two circuits respectively and D, D′ the secondaries, connected with the commutators as above described. A small synchronous motor S for rotating the brushes is indicated.

A thermostatic alarm is the subject of a patent granted to Charles Cuttriss, whose principle of operation is dependent upon the expansion in a drum of a medium such as a cut, in which provision is made for a slow escape or influx of the medium. These conditions being secured, any expansion of the confined air, which increases its volume more rapidly than the leakage can compensate for, will result in the operation of the device, without regard to the actual degree of temperature from which the rise took place. In Fig. 5 A represents an ordinary sheet metal drum or case with deep circumferential corrugations, closed at the top by a metal plate or head, B, in which is set in an insulating bushing an adjustable contact screw. Beneath the screw and solder or fixed to the bottom of the device is a conducting pin or stud, E. A circuit is made from the metal case to the insulated screw, and includes a battery, F, and the magnet, G, of a relay controlling the circuit of a battery, K, containing an alarm bell. In the head, B, is inserted a small body of porous material, H, such as a section of the unglazed earthenware used for battery jars, or in any other way provide a leak, or retarded passage for a slow escape and influx

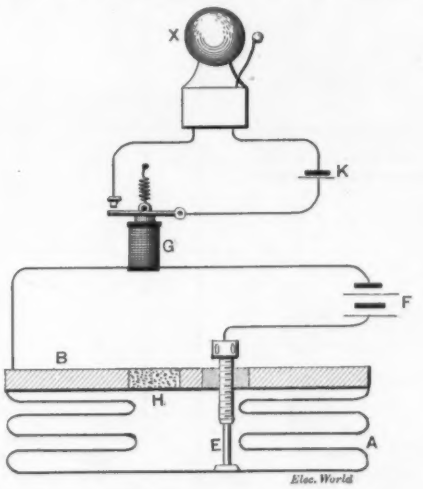


FIG. 5.—THERMOSTATIC ALARM.

of the air or other medium within the device. In practice the leak or breathing hole, as it may be termed, is adjusted so that a variation of temperature of 1° a minute will not produce a separation of the points of contact. Such a variation, while hardly possible from natural causes, might reasonably be expected to be exceeded by almost any fire that would be likely to occur in the neighborhood of a thermostat. Any source of artificial heat, therefore, that would cause a rise of temperature around such a thermostat, at a rate greater than 1° a minute, would produce an expansion of air within the instrument and sound the alarm by producing an elongation of the case.

An important series, three in number, of patents, to which we will refer in a following issue, relate to the Johnson-Lundell electric street railway system, a general description of which appeared in The Electrical World of May 12.

The Lewis Train Electric Lighting System.

In a paper read at the annual meeting of the Association of Railway Telegraph Superintendents, in Detroit, last month, Mr. M. B. Leonard, Supt. Tel. C. & O. Railway, read an interesting paper on the electric lighting of railway trains, from which we abstract the following description of the Lewis system, to which the greater part of the paper is devoted, and which receives high praise from Mr. Leonard.

This system, of which an account of its application to electric lighting from windmills appeared in our issue of February 3, 1894, is the invention of Lieut. I. N. Lewis, U. S. A., and consists of a dynamo fixed on the car truck itself and flexibly belted to the car axle, which charges a storage battery of 12 cells carried under the car and at the same time, if necessary, supplies current for lamps in the car. The illustration shows the details of the connection between the dynamo and the car axle, and also the arrangement of the various circuits. The Lewis dynamo

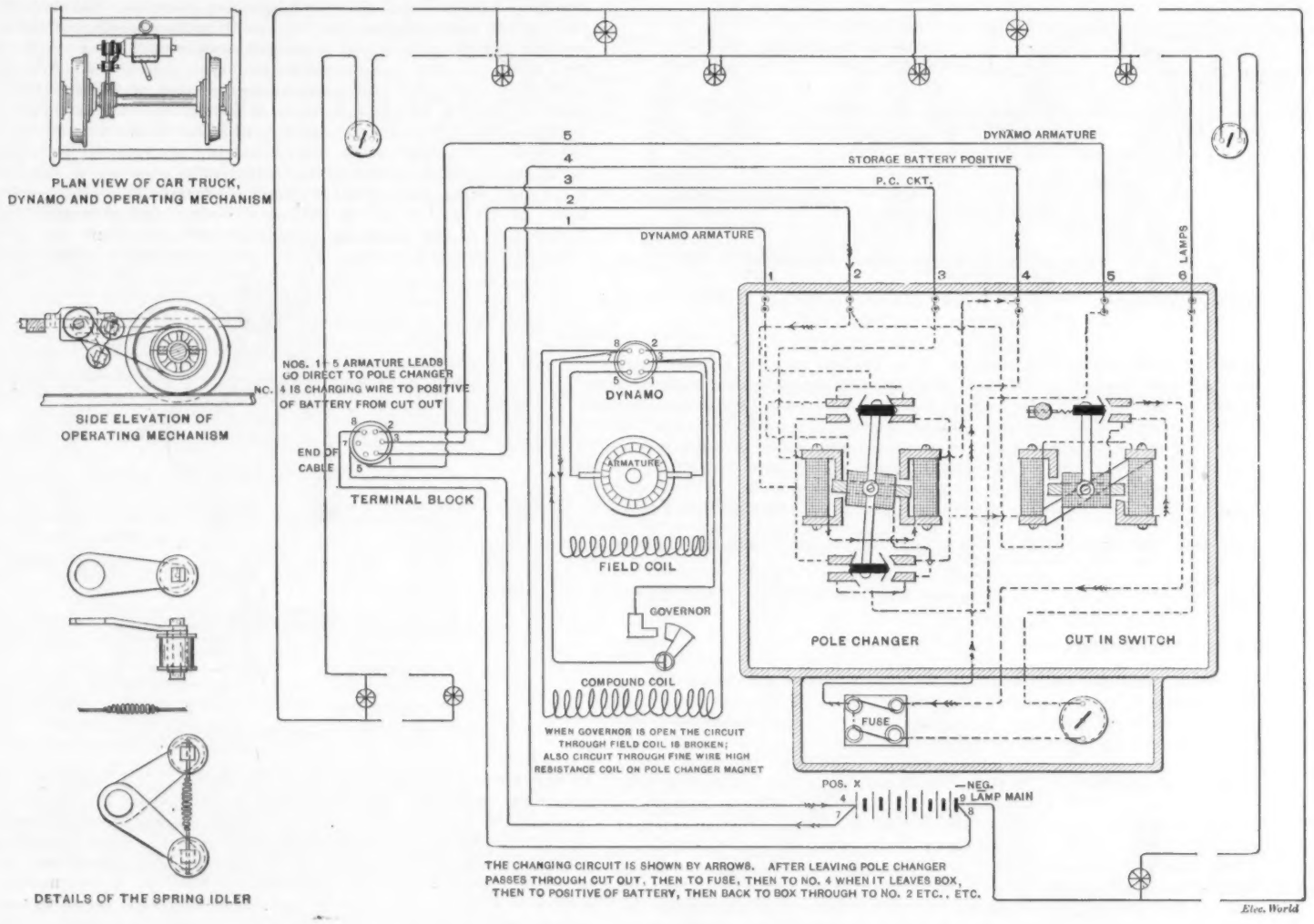
employed is one having a maximum output of 25 volts and 50 amperes. Rectangular carbon brushes are used, which are fixed in position. The machine is iron clad, being fitted with a close iron cover protecting the commutator, fields and the brushes. Graphite bearings are used for the armature shaft and do away with the use of oil. The frame is bolted to the bolster or truck beam, and connected by a rawhide belt three inches wide to a 20-inch pulley on the axle, the armature shaft carrying a 7¼ inch pulley. The distance between pulley centres being small, the belt is kept tight on the armature pulley by a pair of spring idlers, consisting of two flanged pulleys 4½ inches in diameter, over which the belt runs, revolving in graphite bearings and held together by the spiral spring on each side with adjustable nuts.

The distinguishing feature of this system is the way the dynamo is wound, through which it is made self-regulating for all speeds and gives a nearly constant potential at the battery terminals without employing any of the auxiliary regulating devices heretofore necessary in axle-driven dynamos to obtain this constant E. M. F. at varying speeds of the train. This regulation Lieut. Lewis accomplishes by a reverse winding of the series coil, the current passing through this coil going in an opposite direction to that in the shunt; the latter is fed from the storage battery, position the lever would thus be forced to take, it would, by means of the brushes on its end, reverse the relation between the armature and storage battery poles, thus sending the current through the battery in the same direction as before.

The cut-out switch consists of a pivoted electromagnet connected to the storage battery circuit, facing another electromagnet through which the armature current flows. When the current in the latter attains a certain strength, the lever magnet is attracted against the face of a spring, thus making the charging current, which is broken when the current falls below the specified amount or is reversed.

The accompanying diagram, which shows the wiring of the car on Mr. Leonard's road, illustrates the several features above described. The battery in this case will furnish about eight hours' lighting when the car is stationary.

The storage batteries which according to Mr. Leonard have been the most satisfactory are the chloride accumulators. The batteries are carried in a box under the car out of the way, which is pierced with holes to allow the gas evolved in charging to escape. With four or more cars they are fitted with a special form of switch which opens the charging circuit automatically whenever the battery is fully charged, thus preventing


PLAN VIEW OF CAR TRUCK, DYNAMO AND OPERATING MECHANISM
SIDE ELEVATION OF OPERATING MECHANISM
DETAILS OF THE SPRING IDLER
DYNAMO ARMATURE
STORAGE BATTERY POSITIVE
P.C. CKT.
DYNAMO ARMATURE
LAMPS
NOS. 1 - 5 ARMATURE LEADS GO DIRECT TO POLE CHANGER
4 IS CHARGING WIRE TO POSITIVE OF BATTERY FROM CUT OUT
END OF CABLE
TERMINAL BLOCK
DYNAMO
ARMATURE
FIELD COIL
GOVERNOR
COMPOUND COIL
POLE CHANGER
CUT IN SWITCH
FUSE
WHEN GOVERNOR IS OPEN THE CIRCUIT THROUGH FIELD COIL IS BROKEN; ALSO CIRCUIT THROUGH FINE WIRE HIGH RESISTANCE COIL ON POLE CHANGER MAGNET
POS. X
—NEG.
LAMP MAIN
THE CHANGING CIRCUIT IS SHOWN BY ARROWS. AFTER LEAVING POLE CHANGER PASSES THROUGH CUT OUT, THEN TO FUSE, THEN TO NO. 4 WHEN IT LEAVES BOX, THEN TO POSITIVE OF BATTERY, THEN BACK TO BOX THROUGH TO NO. 2 ETC., ETC.
Elec. World

Train Electric Lighting System.

and its circuit automatically opened by a switch on the end of the armature shaft in order to prevent waste of the battery current when the car is standing still. By this means the E. M. F. does not vary more than a few volts, notwithstanding large variations in the speed of the train.

Next to the dynamo the important features of the system are the pole changer and automatic cut-out. The former insures that the charging current is always of the same polarity, and the latter cuts out or cuts in the storage battery when the dynamo voltage falls below, or when it attains a specified amount, thus preventing the battery from discharging through the dynamo in the former case. Both of these are placed in a small box with a glass face which may be put up anywhere in the car, as no attention is required.

The pole changer consists of an electromagnet in the form of a vertically pivoted lever, with contact brushes on one end, and through whose coils the armature current passes. The lever is so arranged as to be controlled by two other electromagnets receiving their current from the storage battery. Should the direction of the car be reversed, the reversal of the armature current would follow, the polarity of the lever would be changed, and it would be repelled from the magnet which formerly attracted it and attracted by the one which before repelled it; in the new unnecessary drafts on the locomotive for power. As the apparatus does not operate until the train has attained a speed of about 20 miles an hour, no extra work is imposed on the locomotive in starting the train. The entire apparatus is entirely automatic in its operation, requiring no expert attention, except a periodical inspection at the terminal points, and has given excellent satisfaction on the C. & O. Railway as well as on the car that has been running for some time on the Brooklyn Bridge in New York, where another one is about to be installed. In regard to the dynamo-axle system employed, the Telegraph Superintendent of the London, Brighton & South Coast road, where it has been used for four years, states that there have been but two failures in that time; that the apparatus can be used for several weeks at a time without attention except lubrication, and at the end of this time only a readjustment of the commutator brushes is necessary to put the machine in condition for a like period. Mr. Leonard believes that there is no reason why the Lewis dynamo-axle system will not show as good a record as this, if not better, as no oil is required for lubrication and no adjustment of the carbon brushes is necessary.

The following is a synopsis of the cost with the different systems of train lighting referred to in the paper, in which, however, the average

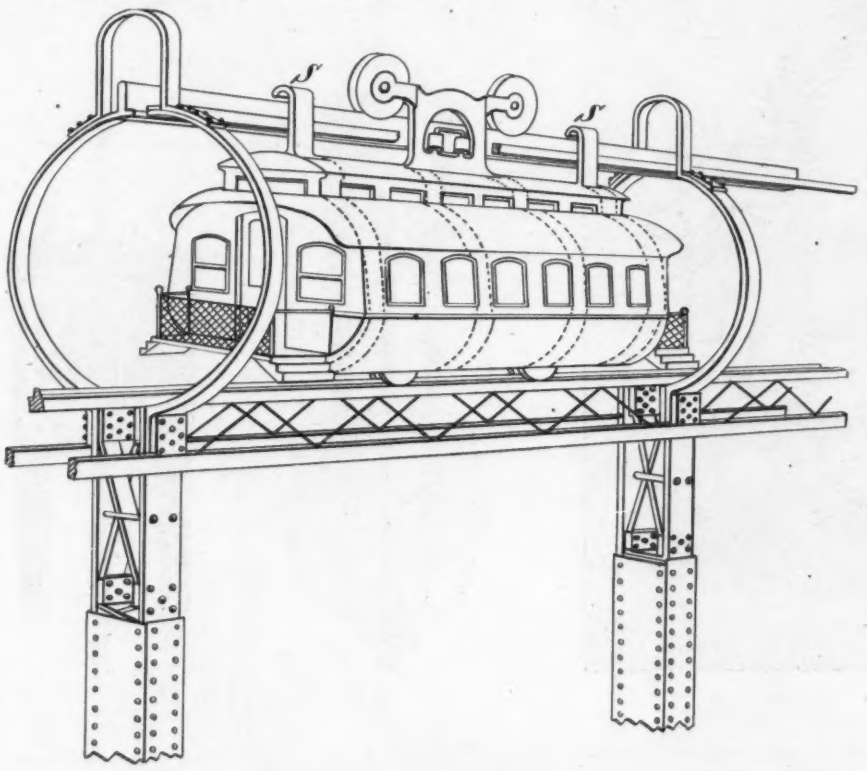
cost given per car for the Pintsch does not include the proportional cost of generating and compressing apparatus.

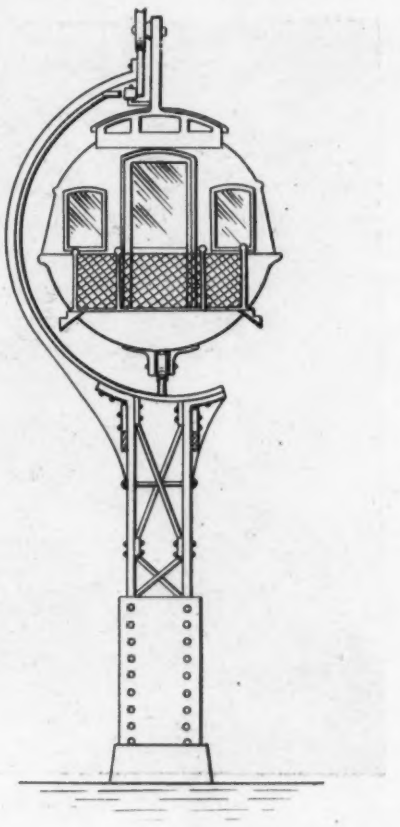
System.	Avg. cost pr. car 16 c. p.	Avg. lamp pr. car.	Total illumination pr. car, candles	Cost pr. car day.	Cost pr. car hour, in cents.	Cost pr. lamp hour, in cents.
Com. dynamo and storage battery.	$968.00	22.5	360.	$1.99	19.90	.88
Silvey battery (C. & O. road).	709.00	9.3	148.8	0.944	9.44	.82
Storage battery (Pullman Co.	650.00	27.	432.	1.694	16.94	.70
Direct current, (C.,M. & St. P.)	338.00	18.	288.	0.977	9.70	.54
Lewis—operated from car axle.	500.00	12.	192.	0.479	4.79	.39
Pintsch, gas	400.07		148.8	0.943	9.43	
Oil	72.00		148.8	0.636	6.36	

Single Post Elevated Railway.

The elevated railway system we illustrate, the invention of J. P. Hanlon, Boston, is intended especially for electric traction, though any motive power can be used. The weight of the car or cars can be sustained equally by the upper and lower rails or three-fourths carried by one and one-fourth by the other, any of which dispositions will prevent lateral oscillation or any undue divergence of the cars from their proper path of travel; hence by this system, it is claimed, a single post line for an elevated railway can be employed with the advantages of the least amount of friction, and safe, smooth and rapid transit.

Fig. 1 represents a side elevation of the superstructure and car placed between the rails, the lower rail being supported by a series of columns or posts arranged along the curbing of the sidewalks, or centrally of the street, as may be preferred, or as circumstances dictate; and the upper rail is supported by iron girders surrounding the car and resting on and supported by said columns or posts. Fig. 2 represents an end view of the superstructure and car between the rails with guard rails occupying a position on either side of the car hanger and about midway between the roof of the car and the upper rail.





FIGS. 1 AND 2.—THE HANLON ELEVATED RAILWAY.

In rounding or traversing curves, and to prevent any tendency of the cars from leaving the rails, there are provided guard rails arranged concentric with the upper rail line and supported by a series of oval iron girders. There are also two horizontally revolving anti-friction wheels, which are so located as to impinge against the guard rails when the car is traversing curves, and thus counteract any strain that may be brought on the upper and lower wheels and their connecting parts. The system is not confined to the particular disposition of the guard rails on curves alone, since they may be introduced continuously along the line, with equally good results. In traversing curves, it will be understood that each wheel of the upper and lower sets is not only journalled separately, but also capable of motion within a pivoted truck, as is the case in ordinary railway car trucks; hence it is obvious that each wheel will adjust itself to a curve of any radius, however small.

Fig. 1 also illustrates the position of two safety hangers marked S S, which are attached to the car for the purpose of holding and sustaining the car on the upper rail in case any or all the wheels should be broken or displaced.

The length of the car, including platforms, is 50 feet; width of car, 6 feet; height, 8 feet. The seating capacity of each car is 70 passengers, and the carrying capacity 110 passengers. The weight, including wheels, motors and 60 passengers is about 9 tons.

The claims made for the system are as follows:

A perfect natural poise and adjustment of the cars upon the rails, rendering it possible to combine such ease and smoothness with the greatest rapidity of motion that the impression received by a passenger or spectator is that of a swiftly gliding motion; the peculiar construction of the superstructure, which offers the least possible obstruction to light and air; the mechanical impossibility of the cars leaving the rails, rendering an accident very improbable and almost impossible; the wheels being but few in number and natural in position, this system can be operated with one half the power required for any other system; while all other systems require a large section of the superstructure to be moved on a turntable to allow the cars to cross at right angles this system requires but a small portion of the upper rail only to be moved; in switching, all other systems require that a large section of the superstructure be moved, while in the Hanlon system switching is done by moving a small portion of the upper superstructure only, as the lower rail moves without interfering with the lower part of the superstructure.

This system of elevated railways has, we are informed, been critically examined by competent and impartial engineering and electrical experts, who have pronounced it entirely free from all the dangerous and other objectionable features of the systems that have been or are now being considered in the Massachusetts legislature in connection with Boston rapid transit projects. It is the intention of the syndicate having charge of this system to make application to the Massachusetts legislature for a charter to construct, equip and operate said system through Boston and its adjacent cities and towns.

Direct Connected Multipolar Generators.

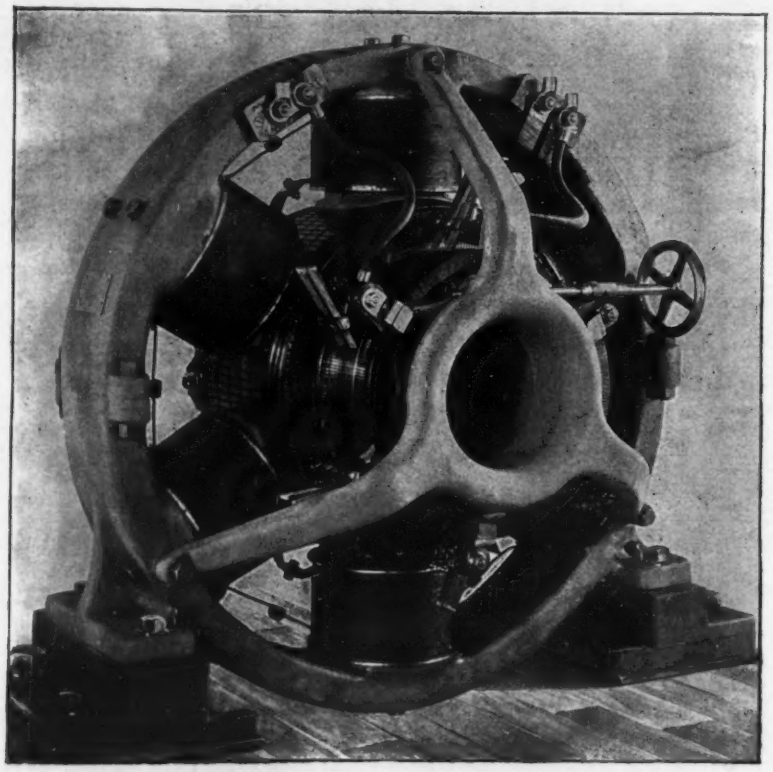
The new type of direct connected multipolar generators for lighting purposes which the General Electric Company has been manufacturing for some time past with signal success is herewith illustrated. It will be seen that a very large part of the material used is available for magnetic purposes. The magnetic circuits are shortened and a greater output with a higher efficiency can be obtained from a given weight and speed. Their shape in itself is an advantageous feature as it allows of a great saving in station space and consequent economy in real estate investment.

The frames and pole pieces are cast from a special soft steel of very high magnetic permeability, and the construction of the armatures is such that a constant current of air circulates through the core and windings and provides the necessary ventilation. The armature windings consist of straight copper bars so connected as to render short circuits or similar troubles practically impossible. The insulation is built up of

alternate laminations of tough paper and sheet mica, joining high spark-resisting qualities with great mechanical strength and durability. The machines are designed for very small rise in temperature at full load, the limit on the standard machines being only 40° C. above the surrounding air after a continuous run of ten hours, while in the dynamos constructed for the U. S. Government the limit is reduced to 28° centigrade.

The General Electric Company's multipolar generators are divided into two classes, the "smooth body" and the "iron clad," the distinction lying in the construction of the armatures, the field frame remaining the same, with, of course, the number of poles differing with the capacity of the generator. The smooth body armature is used for the larger and the iron clad for the smaller sizes. In the smooth body armature the bars are separated from each other, and the constant circulation of air and the large surface area render the armature remarkably cool running. The bars connecting the inner and outer winding form the commutator, and as they are an integral part of the winding, the extra resistance from connecting leads, contact surfaces, etc., an important consideration in large machines, is eliminated. Each of these armatures has practically two commutators, one on each side, so that when one has worn down the armature may be turned around and a new commutator be presented to the brushes which are all in view of the dynamo attendant from the floor of the engine room. These machines are sparkless.

The iron clad armature derives its name from the manner in which the core is slotted. When the conductors are placed in the slots they become



Direct Connected Multipolar Generator.

practically embedded in the body, and thus the iron of the armature being brought closer to the pole pieces, the reluctance of the magnetic circuit is reduced and the capacity for a given weight increased. The copper when placed in these slots is not penetrated with magnetic lines, the total flux passing through the teeth. Large solid copper bars may be consequently used as conductors without loss from eddy currents, and the armature winding becomes an ideally simple mechanical structure. The ventilation, insulation and facility of repair are of similar excellence to those of the smooth body type. The commutators are bolted directly to the body, and a flexible strip connects the sections of the windings with the commutator bars. On the larger sizes the clamping ring holding the commutator bars is made in sections. This allows of all the bars to be held in place with rigidity, and in case of a cross, or burn out of insulation between the bars, only a comparatively small section of the commutator need be disturbed to remedy the defect. The brush holders are all mounted on a spider or rocker arm, and may be all moved simultaneously by means of hand wheels. The brushes are of woven metal gauze, and upon which form of brush the General Electric Company holds the fundamental patents.

These multipolar generators are made in sizes ranging from 25 kw. to 800 kw. and for speeds ranging from 300 revolutions in the smallest to 90 revolutions in the largest. They may be run at other speeds, giving of course a change from the normal voltage. At any speed the voltage of the generator may be raised 50 per cent. and lowered 10 per cent. from the normal value which corresponds to this speed without impairing the satisfactory operation of the machine.

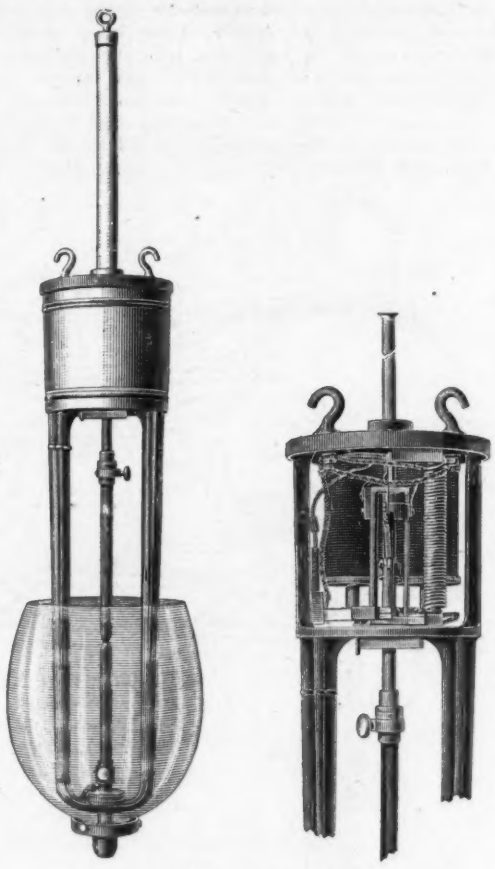
These machines may be connected directly to horizontal engines of the Corliss type or vertical engines of the marine type, triple or quadruple compound. The smaller sizes may also be connected to engines of the high speed type.

Improved Arc Lamp.

This lamp, shown in the accompanying illustrations, manufactured by Samuel W. Rushmore, 89 Liberty street, New York, is designed to meet the requirements of a simple and durable lamp for street lighting on the constant current or arc dynamos. Its chief claims for improvement over other forms lie in its extreme simplicity and solid construction, together with a most perfect clutch feed mechanism, that works perfectly even after very long use.

While the lamp contains a number of new features its most excellent ones are due to the careful design and the proper adaptation of devices that years of service have shown to be the best. The entire lamp frame is a single and very simple casting. The feed clutch is very simple, and the electrical control of the feed is so powerful that it is not at all necessary to have the clutch in the best condition for an even feed.

One of the greatest troubles with clutch lamps is the uneven wearing of the rod, and in this lamp the rod is made of phosphor bronze, insuring



Arc Lamp.

a much longer wear. The lamp has a positive cut-out that forms a part of the feeding mechanism and when the carbons are consumed the lamp is automatically short-circuited, in addition to the regular cut-out, so there is no chance of an open circuit on the line. This lamp is made to burn fourteen hours on any constant current circuit. It has a hand switch is entirely waterproof, and is neat in appearance for interior lighting.

New Commutator Lubricating Compound.

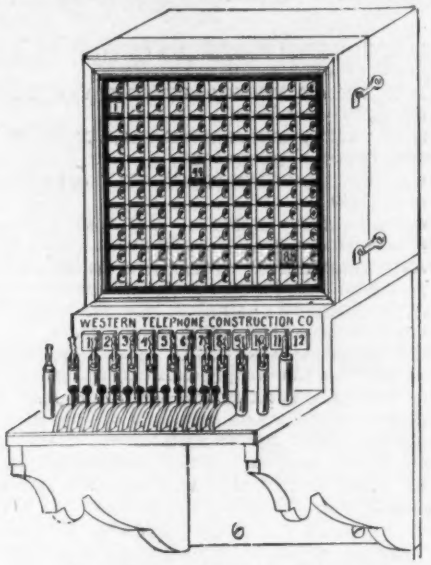
The Knott Manufacturing Company, 796 Seventh avenue, New York, has placed upon the market a commutator lubricating compound that is meeting with much success. It is compounded on new principles and is claimed to avoid the objections urged against similar articles in the past. It is made up only of vegetable substances and contains no vaseline, paraffine, beeswax or glycerine. It is easily applicable to all descriptions of commutators and is claimed to be a great economizer of brushes and commutators. A feature to be considered in the use of such compound is that the brush upon being removed does not require immersion in benzine or other cleansing material, as the compound volatilizes upon application and leaves on the commutator a highly polished and carbonized surface.

A Hopeless View of the Case.

"Improvements in primary batteries, while of considerable scientific interest, are of little or no commercial value."—London "Electrical Review."

New Telephone Switchboard.

We illustrate herewith a new switchboard for telephone exchange work now being manufactured by the Western Telephone Construction Company, of Chicago. The illustration shows a one-hundred subscriber exchange, which can be equipped either with metallic circuit or single wire. It is claimed for this board that it is the simplest switchboard yet



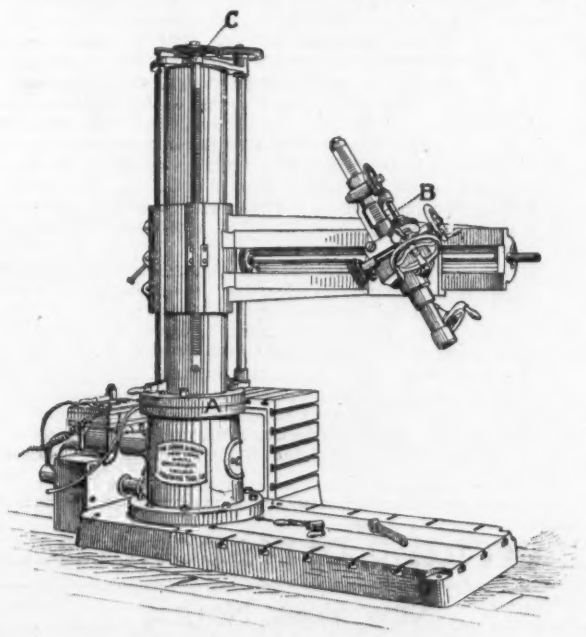
TELEPHONE SWITCHBOARD.

produced. Its compactness may be appreciated from the dimensions of the one-hundred subscriber board, which are 10 in. in width, 15 in. in length and 9 in. in depth, outside measurement, including cabinet. The operation is very simple. The electromagnetic armature is back of the jack, and the drop, or shutter, in front. The drop falls by gravity, and the same movement which inserts the plug into the jack restores the drop. It is also claimed for this exchange that it requires but one-third the service for the same number of subscribers as required by the most approved forms of board now in use. These switchboards are manufactured in all sizes up to one-thousand subscriber capacity.

Motor Driven Radial Drill.

The accompanying illustration is of a new half radial drill, built by the Lodge & Davis Machine Tool Company, of Cincinnati, O., and designed to be driven by a direct connected motor.

The motor is of the iron clad type, entirely covering the armature, pole



MOTOR DRIVEN RADIAL DRILL.

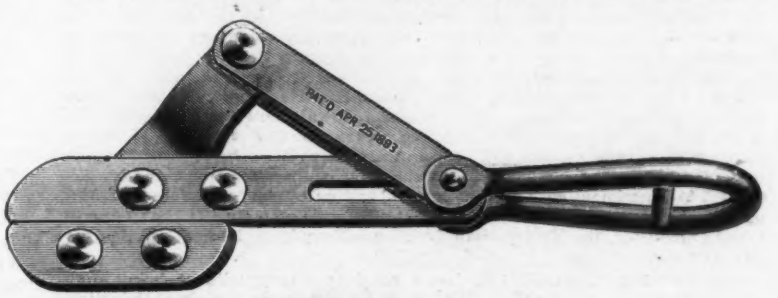
pieces and field coils, with commutator and brushes extending outside of the motor housing. It is free from external magnetism, which is necessary in order to keep small particles of steel and iron from adhering to the drill. The armature is mounted on a bronze spider, which is attached to the cone pulley.

The controlling lever is arranged on top of the motor, and by a semi-circular movement of same all forward and backward speeds may be instantly obtained. This, together with the back gears, at the rear of the swinging arm, gives not only a much wider range of speed than can be obtained by a cone pulley, but a much more finely graduated speed.

The column swings around an internal stump and rests at its lower flange, A, on balls to insure easy movement. The thrust on the elevating screw at C and the drill spindle at B is also taken up on ball bearings. The drill head is moved on the arm by a hand wheel, rack and spiral pinion, which is always within reach of the operator. The spindle is spring balanced, and fed by a rack and pinion in connection with the quick return, which can be instantly released, a valuable feature for tapping. The feed is obtained by pin gearing and can be changed while the drill is running.

The Buffalo Grip.

In the accompanying illustration is shown a simple but ingenious device for linemen, which has been found especially useful in telephone



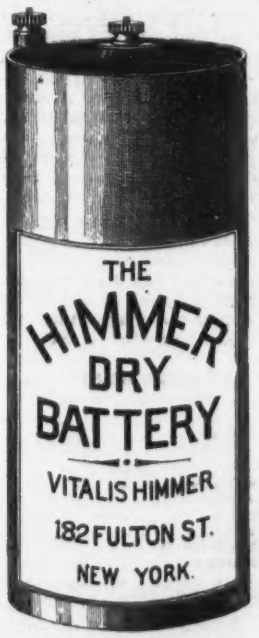
THE BUFFALO GRIP.

line construction. It has been styled the "Buffalo grip." The cut gives a very clear idea of its construction and its method of operation can readily be seen. This tool is sold exclusively by the Western Electric Company, of Chicago and New York.

A New Dry Battery.

Since its introduction the popularity of the dry battery has been constantly on the increase on account of its adaptability to places and purposes for which a liquid cell would be impracticable. The dry cell will stand much hard usage and still be ready for service when called upon. In the accompanying cut is shown a cell of the Himmer dry battery, manufactured by Vitalis Himmer, Sr., 182 Fulton street, New York.

A recent improvement, invented by Vitalis Himmer, Jr., and embodied in this battery, has made it possible to furnish from a single cell a dis-



IMPROVED DRY BATTERY.

charge of from 12 to 20 amperes at 1.5 to 1.8 volts and maintain it for a considerable length of time. The depolarizing properties of the battery are exceedingly good, recovering itself very quickly. This battery is particularly suited for cauterizing and other surgical purposes, as well as blasting and firing heavy guns, and should come into very general use for these purposes. In recent tests for the U. S. Navy, a battery of four cells gave 45 explosions per minute and reached 1,000 explosions before being exhausted. It is also being used for field telegraph and telephones, giving excellent service.

Financial Intelligence.

The Electrical Stock Market.

New York, July 21, 1894.

THE ELECTRICAL STOCK MARKET has shown evidences of new life. The whole financial situation has been immensely cleared of recent days, and were it not for the uncertainty in regard to the ultimate fate of the tariff bill, all business quarters would be sure to feel a new impetus. As it is what trading there is in the stock market is purely professional and the course of quotations reflects more the manipulation of the purely trading element than any specific development in business conditions.

GENERAL ELECTRIC'S course is a good indication of the effort to make quotations. Very little has been really doing in the stock, yet at times there is an appearance of strength and activity more apparent than real. There is a big pool at work trying to boost quotations, but, with trading everywhere restricted and with outside interest in the market conspicuous only by its absence, it is hard work to do anything more than to keep quotations steady. In their endeavor to put General Electric's price up a few points, the bulls on the property recite all kinds of favorable stories to warrant the stand they are taking. Efforts were made this week to revive the reports of a deal to equip the New York Elevated Railroad system with electric motors, but, as stated last week, while such a contract would be very pleasing to the General Electric people, the Manhattan Elevated Railroad Company has determined to await entering on negotiations to this end until the results of similar equipments on the two Chicago elevated lines are more fully established. An announcement of more definite value to General Electric stockholders is that the Metropolitan Traction Company has decided to experiment with an underground trolley system for surface lines, the patents of which are owned by the General Electric Company. If the system is found practicable, the Metropolitan Traction will equip all its new lines in this city with it.

WESTINGHOUSE ELECTRIC issues continue strong without being over active. There is a renewed disposition to buy the common stock in anticipation of the beginning of dividends at the time of the next quarterly distribution on the preferred stock; but the lifelessness characterizing the market prevents any decided trading. An officer of the Westinghouse Company is quoted as saying: "Business is keeping up better than was expected. The company expects to occupy its new shops at Brinton, near Pittsburg within the next 60 days."

THE STREET RAILWAY AND ILLUMINATING PROPERTIES demonstrated again this week the value of the bargain made with the General Electric Company by cancelling two more lots of preferred stock out of the proceeds of dividends and interest payments on treasury assets. On the 16th there were purchased 506 shares at an average price of $98.76 per share, as against $98.375 per share paid for 608 shares on July 11, and on the 20th inst. 505 more shares were bought at an average price of $99.10, making 13,561 shares purchased to date.

AMERICAN BELL TELEPHONE stock holds very strong; the firmness is remarked by interested traders, but no new developments have arisen to lend any peculiar significance to quotations.

WESTERN UNION TELEGRAPH is one of the strongest of the dividend-paying group of stocks. The recent rise is said to have been due not only to a continuance of the investment demand but to the operations of a small pool founded on the strength of the semi-official assurances that the earnings of the company were exceeding all expectations. In fact, it is understood that the revised statement of June will show a considerable increase over the preliminary estimate furnished at the quarterly meeting last month, while the receipts for July, despite the big railway strike, are said to be nearly equal to those for the corresponding period last year.

FT. WAYNE ELECTRIC stock continues strong on assurances that it will realize in liquidation nearer $5.00 than $4.00 per share. The Fort Wayne Electric Company is running its factory "in liquidation" and the new Fort Wayne Electric corporation is buying and reselling the output. A statement from the minority stockholders in defence of their action in wresting the control of the company from the General Electric is promised at an early date.

MEXICAN TELEPHONE stock has been weak a little on reports of aggressive competition in the City of Mexico, but the Boston officials of the company say that they know of no new concessions having been granted, and, as they have the exclusive right to use Bell and Blake telephone patents in Mexico, it is hard to see how any other company can occupy the field. The operations of the company for the three months ended May 31 last show net earnings of $13,495, an increase of $2,396 over a similar period in 1893.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Brush Ill., New York	50	10	30
Cleveland General Electric Co.	100	80	90
Detroit Electrical Works	10	3	4
East River Electric Light Co.	100	—	50
* Edison Electric Ill., New York	100	96	98
* " " " Brooklyn	100	100	102
" " " Boston	100	117	120
" " " Chicago	100	135	145
* " " " Philadelphia	100	122	124
Edison Electric Light of Europe	100	1	3
Edison Ore Milling	100	10	15
Electric Construction & Supply Co., com	15	15	17½
" " " " " pref.	15	15	17½
Fort Wayne Electric	100	1	2
General Electric	100	36	36⅛
Interior Conduit & Ins. Co.	100	45	55
Mount Morris Electric	100	25	50
Westinghouse Consolidated, com.	50	35	36
" " pref.	50	50½	51½

BONDS.

Edison Electric Ill., New York	1,000	106½	107
Edison Electric Light of Europe	194	75	85
General Electric Co., deb. 5's	1,000	86¼	86½

TELEGRAPH AND TELEPHONE.

American Bell Telephone	100	194	194½
American District Telegraph	100	—	45
American Telegraph & Cable	100	89½	90
Central & South American Telegraph	100	105	110
Commercial Cables	100	125	—
Gold & Stock Telegraph	100	100	102
* Mexican Telegraph	100	190	200
* Western Union Telegraph	100	85¼	—

*Ex. div.

New Incorporations.

CITIZENS' TELEPHONE EXCHANGE COMPANY, Jersey City, N. J., capital stock $150,000, has been formed.

THE FIRE AND POLICE TELEGRAPH COMPANY, Louisville, Ky., has been incorporated, capital stock $50,000.

THE MANSFIELD TELEPHONE AND MESSAGE COMPANY, Mansfield, O., capital stock $50,000, has been incorporated.

THE GRAND RAPIDS MACHINE ELECTRIC COMPANY, Grand Rapids, Mich., capital stock $10,000, has been formed.

THE DELAWARE VALLEY ELECTRIC RAILWAY COMPANY, Philadelphia, Pa., capital stock $1,000,000, has been formed.

THE PNEUMATIC FIRE ALARM TELEGRAPH COMPANY OF NEW YORK, Jersey City, N. J., capital stock $250,000, has been formed.

THE MUSICAL TELEPHONE COMPANY, Saco, Me., capital stock $100,000, has been formed to manufacture and deal in telephones, etc.

THE DEFIANCE LIGHT AND RAILWAY COMPANY, Defiance, O., capital stock $100,000, has been formed to supply electricity and gas.

THE MURPHY POWER COMPANY, Chicago, Ill., capital stock $3,000, has been formed to generate electricity for light, heat and power.

THE CO-OPERATIVE HEAT, LIGHT AND POWER COMPANY, Sioux Falls, S. D., capital stock $50,000, has been formed to generate gas, etc.

THE NASCENT EXTRACTION METAL COMPANY, Denver, Col., capital stock $100,000, has been formed to extract metals from earth by electricity.

THE DULUTH-SUPERIOR TRACTION COMPANY, Elizabeth, N. J., capital stock $2,000,000, has been formed for the purpose of operating street railways.

THE UNITED ELECTRIC CORPORATION, Minneapolis, Minn., capital stock $10,000, has been incorporated to manufacture electrical apparatus and to operate lighting, power and railway plants.

THE FARIES MANUFACTURING COMPANY, Decatur, Ill., capital stock $50,000, has been formed to manufacture electric light holders, etc, etc. Robt. Faries, Wm. E. Surface and E. P. Irving are the promoters.

THE ELDRED ELECTRICAL MANUFACTURING COMPANY, Eldred, N. Y., capital stock $10,000, has been formed to manufacture and sell electrical appliances, engines, boilers and machinery. W. C. Ranney, L. B. Doman and A. E. Doman are interested.

THE KEYSER ELECTRIC LIGHT COMPANY, Keyser, W. Va., maximum capital stock $50,000, has been formed to produce and distribute electricity for lighting, etc. F. M. Reynolds, J. M. Templeton and Andrew Keenan, all of Keyser, are the promoters.

THE SEATTLE HOME TELEPHONE COMPANY, Seattle, Wash., capital stock $100,000, has been formed to do a telephone, telegraph and general electrical business. J. H. McGraw, J. D. Lowman, A. B. Stewart, A. M. Brooks and George F. Gund, all of Seattle, are interested.

THE FIRE ALARM CONSTRUCTION COMPANY, New York, maximum capital stock $1,000,000, has been formed to construct, acquire and operate systems of electric and other fire alarms, etc. Leopold Wallach, Henry M. Cross and Maurice Maas, all of New York, are the promoters.

THE CINCINNATI ELECTRIC SERVICE COMPANY, Cincinnati, O., capital stock $10,000, has been formed to build and operate electric lines for telephonic communication and for other electrical service. M. T. Corcoran, Wm. Cullen, J. F. Dougherty, E. D. Whitehead and P. J. Corcoran are the incorporators.

THE OSWEGATCHIE LIGHT AND POWER COMPANY, Gouverneur, N. Y., capital stock $60,000, has been incorporated by H. Walter Webb, A. G. Payne, Wm. J. Arkell, A. L. McCrea, Jr., and A. J. McDonald to furnish electricity and gas to Gouverneur, Edwards, Fowler and other towns in St. Lawrence County.

THE UNITED STATES ELECTRIC FORGING COMPANY, New York, maximum capital stock $1,000,000, has been organized to buy and sell electrical apparatus for heating, forging, welding and otherwise treating metals. E. Garcia, New York, A. C. Garcia, Arlington, N. J., and B. J. Fredericks, New York, are the incorporators.

ELIZABETH, N. J.—The Duluth & Superior Traction Company has been incorporated. The capital is placed at $2,000,000. It will engage in the business of constructing and operating electrical street railways in the cities of Duluth, Minn., and Superior, Wis. The incorporators are Edward V. Douglas, of Philadelphia, John H. Davis, of New York, and Frank Bergen, of Elizabeth.

THE GREAT KANAWHA FALLS, WATER POWER, ELECTRICAL MANUFACTURING AND LAND COMPANY, Charleston, W. Va., maximum capital stock $2,000,000, has been incorporated to utilize the water power of the Great Kanawha Falls and River for the production and transmission of electric power, etc. O. A. Patten, W. W. Tompkins and W. D. Scott, all of Charleston, are interested.

Special Correspondence.

New York Notes.

Office of The Electrical World,
253 Broadway, New York, July 23, 1894.

THE BOARD OF ESTIMATE AND APPROPRIATION, of Brooklyn, has authorized the issue of $15,000 for the erection of new buildings for the fire department, and for conduits for the fire alarm.

THE NASSAU ELECTRIC COMPANY, of Brooklyn, has begun to cart its ties and rails on Rockaway avenue, and work will be speedily pushed on the new railroad from Canarsie Shore to Brooklyn.

HIGHWAY COMMISSIONER HORTON has given consent to the Coney Island, Fort Hamilton & Brooklyn Railroad to construct and operate a railroad by either horse or electric power in the various streets of New Utrecht.

THE COMMERCIAL CABLE COMPANY, 253 Broadway, announces that its new and third Atlantic cable is completed and in working order. This is the tenth year of the company's existence, and it maintains its reputation for speed, accuracy and reliability.

MR. ADOLPH LAMBERT, travelling salesman, representing the Infinity Manufacturing Company, New York city, manufacturers of dry batteries, is meeting with marked success during his Western trip the past two weeks, having taken some very large orders.

THE MANHATTAN GENERAL CONSTRUCTION COMPANY, 50 Broadway, New York, the present agent for New York and vicinity of the Buckeye Electric Company, has just been appointed the exclusive agent of that company for Massachusetts, Rhode Island and Connecticut, in addition to the territory already covered by them. The Buckeye Electric Company has placed its interests in good hands.

VITALIS HIMMER, SR., has resigned his position as general manager of the Himmer & Anderson Dry Battery Company and opened a factory of his own at 182 Fulton street, New York. Having been for the past twenty-six years engaged in the manufacture of electric clocks and the various kinds of batteries, being the introducer of the Gastner dry battery, he is well qualified to conduct the business and produce a battery equal to the best. His son, Vitalis Himmer, Jr., has recently brought out a valuable improvement in dry batteries described elsewhere in these columns.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., July 21, 1894.

THE HARRISON SAFETY BOILER WORKS have established an Eastern branch office under the management of Mr. Sumner B. Merrick, at No. 19 Pearl street, Boston, Mass., who will give his personal attention to their interests throughout the New England States.

GREENFIELD, N. H.—The town of Conway has voted to raise $5,000 toward the stock of the electric road from Conway to the depot. The road is primarily for freight, but passengers will also be carried. Work will be begun at once. The balance of capital, $20,000, has been raised by private subscription.

LAWRENCE, MASS.—The new extension of the Lowell, Lawrence & Haverhill Street Railway to Glen Forest, Methuen, has been opened to the public. The line was christened by the annual excursion of the Merrimac River Boards of Trade on July 10. Messrs. Soule & Dillingham, the contractors, are receiving much praise for the excellent style of the equipment.

MAYOR MATTHEWS is determined to precipitate action with reference to burying wires within the corporate limits of the municipality in accordance with the law enacted by the last Legislature. The nomination of Hon. John R. Murphy as Commissioner of Wires under the law was made by the mayor in order to hasten work, for it is the purpose of the latter to have matters in such shape that preparatory work will have been finished in season to permit corporations to place their wires beneath street surfaces early this Fall.

ENGLISH NOTES.

(From our own Correspondent.)

LONDON, July 11, 1894.

THE FAURE PATENT.—The owners of the Faure patent in this country are petitioning the Privy Council for an extension thereof.

A DAVY-FARADAY RESEARCH LABORATORY.—Mr. Ludwig Mond, of the well-known firm of chemical manufacturers, Brunner, Mond & Co., has just made a munificent gift to the Royal Institution. He has purchased the large house adjacent to the Institution, and proposes to erect therein a laboratory to be called the Davy-Faraday Research Laboratory, which he also proposes to equip and endow in a manner in consonance with the demands of modern science, for the purpose of enabling research work in "physical chemistry" to be carried on.

ELECTRIC RAILWAY ENTERPRISE IN LONDON.—As I wrote to you some time ago the onerous terms in connection with the running of workmen's trains, which the London County Council sought to impose upon the promoters of the proposed electric railway which was to run from the city to Epping Forest, caused the promoters of the scheme to withdraw it. The withdrawal showed the London County Council pretty plainly that the promoters were in earnest when they said capital could not be raised under the conditions proposed, and the result has been that the County Council reopened negotiations with the promoters of the bill, and a compromise has been arrived at which will result in the bill going forward during the present session of Parliament.

A PRACTICAL UTILIZATION OF CATHODE RAYS.—The curious rays emanating from the cathode of a discharge tube, which as Dr. Phillip Lenard has recently shown are both photographically active and magnetically susceptible, have not had long to wait before a more or less practical application has been made of their properties. In a recent communication to the Academie des Sciences, M. Albert Hess proposed to let a cathode beam fall upon a rapidly moving photographic film, and to expose the beam en route to the action of a rapidly varying magnetic field or fields. If this suggestion prove really practicable, it would enable us to obtain a sort of inertialess Ewing curve tracer. The Ewing curve tracer has hitherto been limited, owing to its inertia, to a frequency of about 20.

THE GOVERNMENT AND THE TELEPHONES.—The public pronouncements and general attitude of the Post-Office towards the National Telephone Company have all along been of a very ambiguous character, and it is some satisfaction that an importunate member of Parliament at last should have succeeded in drawing something really definite from the Postmaster-General. There is, I believe, some slight doubt as to the terms upon which the Post Office will be able to purchase the telephonic plant of the National Telephone Company, when its license expires in 1911, but, according to the Post Office reading of the license, the right of the National Telephone Company to carry on telephone exchange business will absolutely cease and determine in December, 1911, and all they will have to sell will be their plant, and even this the Government will be under no obligation to buy.

News of the Week.

TELEGRAPH AND TELEPHONE.

MEMPHIS, TENN.—The Novelty and Electric Company, it is reported, has assigned.

SALISBURY, N. C.—J. Allen Brown and E. B. Neave have secured a franchise for constructing a telephone system, and are now in the market for the necessary equipment.

PHŒNIXVILLE, PA.—The Police Department has concluded to put in a private telephone service, but has not yet decided upon the system it will use. Communications may be addressed to the superintendent of police.

ELECTRIC LIGHT AND POWER.

ST. GEORGE, N. B.—The people are agitating for electric lighting.

LONGUEUIL, CAN.—An electric light system is to be established here.

GUTHRIE, OKLA.—It has been ordered that electric lights be placed in the new county hall.

BARABOO, WIS.—The Common Council of Baraboo is considering the introduction of arc lights.

RICHMOND, IND.—Address Wm. S. Kaufman regarding purchase of electric lighting outfit, bells, etc.

INDIANAPOLIS, IND.—Address R. P. Daggett & Co., 28 Marion Building, concerning electric lighting outfit to be bought.

MEMPHIS, TENN.—Johnson, Carruthers & Rand Co. may be addressed concerning a 20-h. p. electric motor about to be purchased.

SPOKANE, WASH.—William Moore, city clerk, may be written to as to the cost of furnishing that city with lights for street illumination.

PHILADELPHIA, PA.—The Yearsley-Harris Electric Company has changed its title to the Harris Electric Company, Thomas Yearsley having retired.

HOPKINTON, IA.—Hopkinton has decided to have electric lights, and will grant an exclusive franchise to maintain an electric light plant there for a term of 20 years.

FLORENCE, S. C.—Address W. E. Sudlow & Co. regarding electric supplies wanted. Prices are desired on transformers 10s, 20s or 30s, or about 200 incandescent lights.

READING, PA.—The City Council is considering the advisability of the city owning its own electric light plant, and has instructed the city clerk to inquire as to cost of same.

BOSTON, MASS.—Boston is to have another new theatre on the site of the old Arena at Ferdinand and Isabella streets, South End. The theatre will have its own electrical plant.

MASSILLON, O.—Sealed proposals will be received until August 9 for the erection of a power house for the Massillon State Hospital. Yost & Packard, Massillon, O., are the architects.

GOODLAND, IND.—The Goodland Herald is publishing an advertisement for sealed proposals for an electric light plant at Goodland of 35 arcs and 1,000 incandescent capacity. The bid is to be opened July 25.

PITTSBURG, KAN.—A charter was granted to the Pittsburg & Frontenac Suburban Electric Railway Company. Capital $75,000. Samuel Barrett and A. L. Chaplin, of Pittsburg, and Carl J. Simons, of Chetopa.

SPOKANE, WASH.—The Centennial Company's Cereal Factory is being improved. The mill owns 250 h. p., and is only using 140. To make use of the wasted power a complete electric light plant will be put in.

NEW YORK CITY, N. Y.—Architect James Ireland has drawn plans for a new one-story brick electric light station, 22x57, at Nos. 204 and 206 Elizabeth street, to be built by the Brush Electrical and Illuminating Company.

WAUSAW, WIS.—At a meeting of the Council the special committee appointed to ascertain the cost of an electric light plant reported that a plant could be put in at a cost not to exceed $17,000. No definite action was taken by the Council.

ARCADIA, WIS.—At a meeting of the City Council it was decided to do away with kerosene lamps and use electricity exclusively. Arcadia has had an electric plant for some time, but it has been used only for lighting the business houses.

BAYONNE, N. J.—The new electric light company, in whose behalf a petition for a franchise was presented to the Council, is composed solely of Bayonne stockholders—Messrs. Geo. Carragan, Edward F. White, J. S. Packart and Dr. Samuel Myers.

NORWALK, CONN.—The Norwalk and South Norwalk Electric Light Company has had a receiver appointed in the person of L. C. Whitney on a petition brought by the first mortgage holders. Mr. Whitney is superintendent of the New Britain Electric Light Company and has filed bonds for $20,000.

MANITOU SPRINGS, COL.—C. W. Barker, of the Barker House, is interested in the project of establishing a $600,000 sanitarium to be lighted from the company's own electric plant. Electricity will be used in every way as far as possible. F. Baer, of Philadelphia, is also interested.

FREDONIA, N. Y.—Robert S. Bishop, president of American District Steam Company—Holly undergound system—is here looking over the plans of the Electric Heat and Power Company, which proposes to put in the Holly heating system in Fredonia, as well as an incandescent light plant.

WASHINGTON, D. C.—The syndicate of local and foreign capitalists, which recently bought the major part of the "low grounds," and all of High Island, intend to invest about $750,000 in the plant of the scheme and manufacture enough electricity to supply the entire city with light and power.

TORONTO, ONT.—It was decided to call for tenders for lighting the city on the same conditions as at present, the tenders to be in by August 1. When these

tenders are in the committee will consider whether the figures offered are such as to make it advisable to have the lighting done by a private company.

TOMAHAWK, WIS.—Mr. Bradley will soon commence the erection of a building at the rear of Library Hall to be used as a power house to furnish electric light and steam heat for the Mitchell House, the Irvington Stables, Library Hall and the Tomahawk office. Address W. H. Bradley, president Tomahawk Hotel Company.

SEATTLE, WASH.—A resolution was passed relative to the city lighting, directing the city engineer and city electrician to submit to the City Council on or before July 15 a plan for the lighting of the streets. At present there are many duplicate arc and incandescent lights, and the present contract with the company expires October 1.

ONTARIO, CANADA.—Address City Engineer E. H. Keating concerning a proposed municipal electric lighting system requiring a plant for 1,500 lights of 2,000 candle-power each, to cost $310,000 and to be operated at an expense of $106,000, the lamps burning all of every night, or equivalent to $82 per year per lamp, against $109 now paid to private parties.

SPOKANE, WASH.—Sealed proposals will be received until August 8 for furnishing the city of Spokane with light for its streets and public places. Bidders will be required to state the price per lamp per month, and candle power. All lights must be furnished on what is known as the all-night schedule on each and every night of the year. William Morse is city clerk.

ACKLEY, IA.—H. D. Bruening, who has managed the Eldora Electric Light plant since the start, has severed his connection with the company, and will unite with his brother, D. S. Bruening, of Ackley, and start an electric light plant at that place. The machine shops of S. D. Bruening will be fitted with dynamos, etc., and a three-wire Edison system will be put in in a short time.

NEWARK, N. J.—Sealed proposals will be received until July 31 for plumbing, gas fitting, piping and electric wire conduits for the United States Custom House and Postoffice Building at Newark, N. J., in accordance with drawings and specifications. Each bid must be accompanied by a certified check in a sum not less than two per cent. of the amount of same. Address Jeremiah O'Rourke, Supervising Architect.

The Electric Railway.

WILLIAMSBURG, VA.—Address the Mayor regarding the proposition to construct an electric railway.

CHATTANOOGA, TENN.—The Chattanooga Electric Railway is placed on record as having appointed a receiver.

COLUMBUS, GA.—The North Highlands Railroad Company has been granted a franchise for operating an electric railway.

SAUNDERSVILLE, GA.—J. N. Gimore may be addressed as to the proposed electric railway from Saundersville to Tennile.

WESTMINSTER, MD.—The Baltimore Traction Company will extend its line from Baltimore to Westminster and to Washington.

HAZEL HILL, N. S.—A project is on foot to run an electric railway from Hazel Hill to Canso, N. S., a distance of three miles.

PORTLAND, IND.—A franchise has been granted for an electric railway between Red Key and Dunkirk, and for lighting both with electricity.

WILLIAMSBURGH, VA.—The formation of a stock company to build an electric railway to King's Mill Wharf is in contemplation.

RUTHERFORD, N. C.—Address Jonah White concerning a proposed electric railway to be built from Rutherfordton to Chimney Rock, a distance of 17 miles.

TURTLE CREEK, PA.—The Turtle Creek Valley Electric Railway Company proposes to extend its line through Braddock, Turtle Creek, Wilmerding, and out to Irwin.

SYRACUSE, N. Y.—The Syracuse, Eastwood Heights & DeWitt Railroad Company will complete the railroad which is partially constructed between this city and East Syracuse.

SAGINAW, MICH.—An ordinance giving the River Park Railway the right of way to construct and operate an electric street railway on certain streets was passed with objection.

CANANDAIGUA, N. Y.—M. Dwight Munger, of the Canandaigua Electric Light and Railway Company, has contracted to furnish electric lights for the village of Palmyra, N. Y., for ten years.

BALTIMORE, MD.—Address Thos. S. Hodgson, 6 East Lexington street, president Somerset Electric Light and Railway Company, concerning 2½ miles of electric railway, which is to be constructed.

CLEVELAND, O.—An ordinance has been passed granting the Cleveland Electric Railway right to extend and operate its double-track street railway in Quincy street from New street to Wilson avenue.

HOMER, N. Y.—A franchise having been granted to the Cortland & Homer Traction Company to run its cars through this village by electricity, the work of changing will begin as soon as possible.

KNOXVILLE, PA.—Knoxville Borough Council met and discussed the question of constructing a new electric line from that place to Mt. Lebanon and Castle Shannon. A special meeting will be held Wednesday next to act on the scheme.

BOSTON, MASS.—Four pieces of land on Eagle street, near Eagle Square, in East Boston, comprising in all 300,000 square feet of land, have been secured by the West End Street Railway Company for the site of the new power house for the electric railway system in East Boston.

MONTCLAIR, N. J.—Applications for franchises for electric street railways in Montclair over three designated courses were received from the North Jersey Street Railway Company and referred to a special committee, composed of Messrs. Thompson, Sawyer, Simms and English.

TORONTO, CANADA.—Messrs. Fraser, Morton and H. H. Dewart, solicitors, appeared before the York Township Council asking for the privilege of extending the City & Suburban Electric Railway from its present terminus at Toronto Junction along the Weston road south to the village of Weston.

LAUREL, MD.—At a meeting of the City Council this week a franchise was granted to Messrs. Phelps & Shaffer to build and operate a street railway, with either electric or horse power. The road is to be completed in two years. The probability is that the road will be operated by electricity, generated by water power.

DIXON, ILL.—The City Council has adopted an ordinance granting a franchise to the electric railway company for the laying and operating of a street car line through the city of Dixon. The system is to be a part of the Rock River Electric Railway from Rockford to this city, the right of way for which has already been secured.

READING, PA.—The Reading & Temple Electric Railroad Company has asked permission to extend its line, beginning at Front and Robeson streets, east on Robeson to Centre avenue, to Bern street, connecting at that point with the tracks of the Reading Passenger Railway Company on Centre avenue, and returning by the same route.

DOWNINGTOWN, PA.—A few days ago a group of Downingtown's most influential citizens were talking about the borough needing an electric railway. One of them said that he considered it would be a good investment for private capital to build an L road between this borough and West Chester, and he thought the road could be built for about $40,000 or $50,000.

M'KEESPORT, PA.—Attorney J. A. Henderson, Homer H. Sweeney, Jas. and Dr. Suckstager, all of McKeesport, have made application for a charter, granting them right of way over Youghiogheny River at foot of Fifth street, and also for the purpose of bridging the river and constructing an electric railway three miles long, costing $600,000, to connect Glassport with this place.

ALLEGHENY, PA.—Work on the survey for an electric railway, which will connect Pittsburg with Tarentum, Natrona, Springdale, Freeport and all the numerous intervening towns on the north side of the Allegheny River, was recently completed. The same company of Allegheny capitalists which owns a charter covering a proposed line to Butler by way of Etna and Glenshaw, is said to be interested in the Tarentum and Freeport line.

WASHINGTON, D. C.—In the House Mr. Baker introduced a bill authorizing the Rock Creek Railway to extend a single track from U Street down Seventeenth, to P, to Fifteenth Street, and from Florida Avenue down Eighteenth Street to R, to Fifteenth Street, to I, to Thirteenth, to B, to Seventh; also on U Street through Mt. Pleasant on or near Seventeenth Street, to Rock Creek and Zoological Park. Cable or electric power may be used.

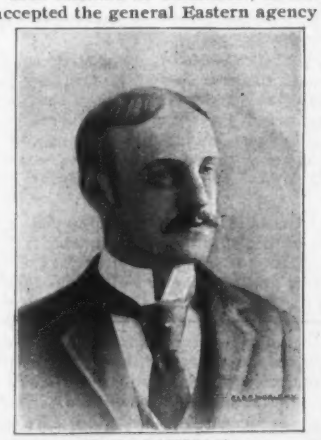
DIXON, ILL.—The City Council has granted a franchise to the electric railway company for the laying and operating of a street car line through the city of Dixon. The system is to be a part of the Rock River Electric Railway from Rockford to this city. The right of way has already been secured. The franchise gives the company the right to use the wagon bridge over the Rock River.

YONKERS, N. Y.—The North and South Railway Company has been incorporated to construct a street surface road about five miles in length, in Yonkers, to run from the vicinity of Shonnard Place to the southern boundary of the city of Yonkers on South Broadway. The capital is $50,000, and the directors are William Delavan Baldwin, S. T. Hubbard, John C. Shotts and T. H. Silkman, of Yonkers, and others.

TRENTON, N. J.—The New York & Philadelphia Traction Company has been incorporated. The capitalization is $10,000,000. The incorporators are: Ex-Mayor Frank McGowan and James P. Durrah, of Trenton, and Jos. H. Reall, of Bloomfield. Associated with them are D. K. Bayne, of New York, and others. The company proposes to construct 150 miles of track in the State of New Jersey, and to connect New York with Philadelphia by a trolley road. The route will be through Newark, and thence by the most direct route to Trenton. Spurs will be built to connect the main line with Paterson, New Brunswick, Rahway, Elizabeth and other cities. The city has the right of way by two routes from this city to Philadelphia. One is down the east bank of the Delaware to Camden. The other is on the opposite bank.

Personal Notes.

MR. HENRY B. OAKMAN, as his many friends will be pleased to learn, has accepted the general Eastern agency of the Wenstrom Electric Company. Mr. Oakman is one of the youngest men in the electrical field, having been born in 1870 in Brooklyn. He received his early education in the common schools of that city, and at the age of 16 entered the electrical field by going with the Electric Supply Company, 17 Dey street, New York, as office boy. His energy and ability soon pushed him to the front and he rapidly rose to the position of salesman and afterwards of buyer. Before he was 18 he accepted a position with the Long Distance Telephone Company as special agent and remained with that company for one year. He then organized the Empire Safety Manufacturing Company, occupying the position of treasurer, a place which he held for about two years. In January, 1891, he accepted an offer from the Edison General Electric Company as city salesman, but in course of a few weeks was promoted to the position of State agent for Connecticut, with offices at New Haven. He remained here but a few months when he was sent to Buffalo by the Edison Company to select a site for a store and show rooms. Soon afterwards he was appointed general Western agent of the Edison Company for the State of New York. This place he filled most satisfactorily to the company, but on the consolidation of the Edison and Thomson-Houston companies he resigned, and believing in the future of the Wenstrom apparatus he accepted a position with the Wenstrom Electric Company. The result was that he has been appointed its general Eastern agent. He also found it advisable to incorporate a company to handle the specialties in which he has become interested, and accordingly the Oakman Electric Company has been incorporated with Mr. Oakman as treasurer.



H. B. OAKMAN.

Miscellaneous Notes.

CHESTER, PA.—Ground has been broken on the left of Science Hall at Swarthmore College for a new building, to be devoted to apparatus and lecture rooms for an electrical department.

THE S. E. TARIFF ASSOCIATION has, on the recommendation of its electrician, Mr. A. M. Schoen, decided to adopt the rules of the Underwriters' International Electric Association for the installation of electric apparatus. This should be gratifying news to the Southern electric workers.

AN EXPLANATION.—In this column of our issue of June 30 we printed a humorous account, clipped from a local paper, of the alleged result of connecting a trolley wire with a wire fence to keep out trespassing animals. We are informed that the article does an injustice to a very worthy man and we regret that it found a place in our columns.

MR. ALLEN RIPLEY FOOTE read a paper before the Northwestern Electrical Association at St. Paul on July 18, entitled "A Question of Public Policy: Shall Public Services be Rendered by Political or Private Monopolies." The argument is an examination of the article in the platform of the Knights of Labor calling for the Government control and operation of all means of transporting intelligence, passengers and freight. The general principle is laid down that non-competitive businesses should be owned and managed by private monopolies under properly guarded franchises and contracts, and a lengthy discussion defines the character of these limitations.

Trade and Industrial Notes.

T. W. NESS & CO., electrical supply dealers, Montreal, Can., have failed with liabilities of $40,000.

THE BALL ENGINE COMPANY, Erie, Pa., reports that its shop is rapidly filling up with work, and that it has received some very large orders during the past few days.

THE SOUTHERN ENGINEERING AND CONSTRUCTION COMPANY, Atlanta, Ga., of which E. W. Dutton is manager, has closed a contract with the Atlanta Cotton Mills for a complete light plant of 400 lights.

THE OHIO VALLEY ELECTRICAL ENGINEERING COMPANY, 84 Johnston Building, Cincinnati, O., has been employed to build a fire and police alarm system for the city of Clifton, one of Cincinnati's most beautiful suburbs.

SCRANTON, PA.—The Scranton Electric Construction Company has applied for a charter for the purpose of manufacturing and furnishing electric plants. Those who are interested are E. P. Sturges, F. E. Platt, O. S. Johnson and others.

THE HARRISON SAFETY BOILER COMPANY, Philadelphia, is building one 8-inch and four 12-inch Cochrane high pressure horizontal separators for use on the steam mains of the Philadelphia Electric Traction Company's Delaware avenue power house.

THE ELECTRIC APPLIANCE COMPANY, 242 Madison street, Chicago, Ill., has found a new field for its Packard-Mogul lamp in the special illumination of parks by street railway companies, as an attraction to increase their passenger traffic. The Mogul lamp is claimed to be particularly adapted for this class of work.

THE GENERAL ELECTRIC COMPANY in April, 1891, installed four 100 kw. multipolar direct-driven dynamos in its Schenectady shops. These have served as examples of the economy and ease of operation of this class of generator, and since then the company has sold nearly 30,000 kw., or about 40,000 h. p., of these machines.

BRADLEY & COMBS, 7 Stone street, Rochester, N. Y., have issued a descriptive pamphlet and price list of their universal telephone switch hook. This hook does not, it is claimed, infringe any Bell Telephone patent, and is compact, neat, universal in application and compulsory in operation, and is well made both electrically and mechanically.

MR. L. W. COLLINS will hereafter be associated in business with Mr. C. E. Lee, 65 Lees Building, 147-153 Fifth Avenue, Chicago, dealer in electrical specialties. Mr. Collins is too well and favorably known to need an introduction here. The new firm will continue with the class of goods which Mr. Lee has hitherto handled, adding occasionally other specialties of merit, according to the demands of the trade, but it is not the intention to carry so large a line but that the firm can feel confident at all times that each specialty is the best of its class.

ARMATURE WINDING.—We take pleasure in publishing the following extract from a contribution received from Mr. S. W. Rushmore, 126 Liberty street, New York, in reply to an item which appeared in these columns last week in regard to his system of armature winding. Mr. Rushmore says: "My winding, although resembling the method described by this party, is radically different, and the method described by them cannot be applied to the Edison armatures with success, and that method can be used only on plating dynamos of a few volts potential."

THE METROPOLITAN ELECTRIC COMPANY, of Chicago, had an interesting experience in the great strike. They had on hand an order for a lot of railway material that was particularly wanted for the 4th of July, in order to enable the railroad manager to fulfill his contract to run a special excursion. The first blow of the strike was especially effective, and practically stopped the movement of all freight trains. The Metropolitan Company, by working hard, succeeded in loading the material on a special car and sending it out by express all right. It reached its destination on time, and the excursion was run as though there were no strike whatever.

THE POPPOWITSCH ELECTRIC COMPANY has purchased a tract of land in New Haven and is proceeding to build thereon a factory which will accommodate 500 to 600 workmen. The company is, meanwhile, manufacturing on a small scale at 215 Java street, Brooklyn. The new factory will be devoted to the manufacture of a number of new inventions, among which may be mentioned the "depolarite" batteries, which are made for bell and other open circuit work, and also for electroplating, electric lighting and motor work on a small scale. George Zucker's Sons, 108 Fulton street, New York, are sole agents for all the manufactures of the company relating to electroplating and galvanoplasty.

THE HARRISON INTERNATIONAL TELEPHONE CONSTRUCTION COMPANY, on account of the large demand for the Harrison telephone, has decided to move its general offices to the Chamber of Commerce Building, Chicago, where, in future, all communications relating to the establishment and construction of exchanges or lease of telephones should be addressed. The general office of the parent, or Harrison International Telephone Company, will remain as heretofore, at 44 and 46 Wall street, New York. On the 1st of August the Harrison International Telephone Construction Company will place on the market the Ford automatic switchboard, which is a device by which connection can be automatically made, and the central office and operator dispensed with.

SAMUEL W. RUSHMORE, 126 Liberty Street, New York, reports that his factory in Jersey City is completely filled with orders for arc lamps, search lamps, commutators and heavy dynamo repairs. He has just closed a contract to rebuild the dynamos of the North Attleboro Steam and Electric Company, of Pawtucket, R.I., whose station was burned last February, and has also arranged to rebuild the large and small machines that were but partly damaged in the fire of the Electric Power Company at St. George, Staten Island. He has orders on hand for twelve search lamps and Mangin mirror lamps, six for the Southern Pacific Steamship Company, and for a number of prominent yachtsmen. Some of the lamps are made specially for running on 500 volt circuits, and a number have been sold this season to railroads for exhibitions. Mr. Rushmore is now putting in some special machinery and will take on a dozen more men. He also reports having great success with the new spiral armature winding.

Business Notices.

BATTERY CUT OUT CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse, N. Y.

OPEN AND CLOSED CIRCUIT CELLS.—The Hayden carbon porous cup No. 1; the Hayden carbon porous cup No. 2 cell; a Leclanche clay porous cup cell; a standard Fuller cell; a No. 2 Fuller cell; a single cylinder carbon cell; a double cylinder carbon cell. All reliable and efficient, and at prices lower than ever. THE HAYDEN-BOOKER MANUFACTURING COMPANY, 2140 DeKalb street, St. Louis, Mo.

Illustrated Record of Electrical Patents.

U. S. PATENTS ISSUED JULY 17, 1894.

522,964. MANUFACTURE OF INCANDESCENT ELECTRIC LAMPS; H. D. Burnett, Lynn, and S. E. Doane, Swampscott, Mass. Application filed December 3, 1892. A fork for the manufacture of incandescent electric lamps, provided with a screw threaded tang, and handle of non-conducting material having a screw threaded socket to engage with this tang.

522,983. GALVANIC BATTERY; G. Hewitt, New York. Application filed September 19, 1893. In a gravity battery, a carbon battery, a carbon porous cup containing bichromate of potash crystals in combination with a solution of bisulphate of soda outside the carbon porous cup.

522,986. SYSTEM OF ELECTRIC DISTRIBUTION AND GENERATION; E. J. Houston, Philadelphia, Pa. Application filed November 17, 1887. The combination with a source of currents of low electromotive force of an induction coil having a low tension primary and high tension secondary, the commutator in the primary, the commutator in the secondary timed to change its connection in unison with the changes in the primary, the condenser across the terminals of the commutator, and the condenser across the terminals of the primary.

522,999. ELECTRICAL CONNECTION CORD; A. H. McCulloch, Boston, Mass. Application filed February 6, 1894. A flexible conductor consisting of a flexible non-conducting tube and a fluid conductor such as mercury, filling the same from end to end.

523,019. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES; E. Thomson, Swampscott, Mass. Application filed February 10, 1894. In a commutator a series of sub-segments surrounded by a band whereby the sub-segments are held in place, in combination with an outer set of wearing segments secured to the sub-segments.

523,027. ARMATURE BAR AND METHOD OF MAKING SAME; G. Weber and C. W. Marcley, Rotterdam, N. Y. Application filed December 22, 1893. An armature bar wrapped with mica paper having a smooth finished surface.

523,055. PROCESS OF MAKING BATTERY PLATES; William L. Silvey, Dayton, O. Application filed September 9, 1892. The process of making secondary battery plates which consists in submerging a perforated cathode and a lead anode in combined alkali and acetic acid solution, connecting the cathode and the anode with a source of electrical supply and thereby depositing the metal of the latter in the perforations of the former, then removing the plates from the solution, next subjecting them to pressure to compact the spongy deposited metal, and finally washing them in water. (See illustration).

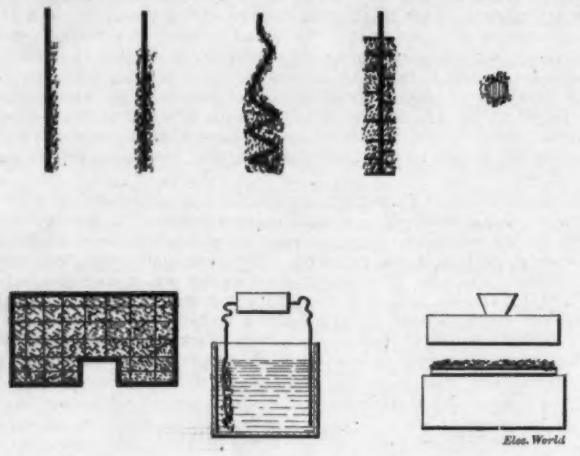
523,074. ELECTRIC SWITCH; Jesse F. Kester, Buffalo, N. Y. Application filed November 28, 1893. The combination with the contact block and the switch lever, of a face plate secured to the face of the contact block and consisting of a non-sparking composition, and a contact plate secured to the lever and adapted to pass from the block to the face plate upon opening the switch.

523,104. ELECTRIC RAILWAY SUPPLY SYSTEM; W. A. Butler, New York. Application filed March 16, 1894. In an electrical railway system, a series of contact devices arranged above the roadway at intervals and connected by a guide in combination with an elongated conductor carried by the car and having one or more grooved wheels running upon this guide.

523,119. QUADRUPLEX NEUTRAL RELAY; Charles D. Haskins, Brooklyn, N. Y. Application filed April 3, 1893. The combination with an electromagnet provided with a stationary core, of a pivotally mounted armature adapted to be affected by the electromagnet and serving as the core of a stationary helix of the electromagnet, the helices being equivalent as to magnetic inductive influence upon their respective cores, these cores being equivalent as to magnetic susceptibility; whereby reversal of the current flowing in the helices causes the magnetization of the cores to fall, change sign and rise in unison.

523,120. ELECTRIC SIGNALING APPARATUS; W. W. Hibbard, Rochester, N. Y. Application filed August 12, 1893. The combination of a main circuit provided with signal boxes, a side circuit, a magnet for controlling the side circuit, a differentiating apparatus with which both circuits are electrically connected, a circuit breaker driven by suitable mechanism and restrained by an electric stop, a magnet for releasing the stop, electrodes attached to the differentiating apparatus in line with the circuit breaker, and a magnet for operating a register at the central station.

523,121. ELECTRIC SIGNALING APPARATUS; W. W. Hibbard, Rochester, N. Y. Application filed August 12, 1893. The combination of a main circuit



No. 523,055.—Process of Making Battery Plates.

composed of two wires provided with signal boxes, a differentiating apparatus having electrical connections with the main circuit, a signal box attached to the main circuit, and a lateral circuit extending therefrom provided with thermostats or manuals.

523,122. DIFFERENTIATING APPARATUS FOR ELECTRIC SIGNAL SYSTEMS; W. W. Hibbard, Rochester, N. Y. Application filed August 12, 1893. The combination with a main circuit of a differentiating apparatus, two insulated electrodes with which the terminals of the main circuit connect, a circuit breaker provided with contact points which rest in line with the electrodes, and means for giving motion to the circuit breaker, the whole so arranged as to close the circuit through the main line by the engagement of the contact point with the electrodes and to open it by their disengagement.

523,123. ELECTRIC SIGNAL BOX; W. W. Hibbard, Rochester, N. Y. Application filed August 12, 1893. The combination with a main circuit composed of two wires, of a signal box attached thereto, a tripping device connected with one wire, and suitable electrical connections, the whole capable, when in action, of opening the wire, transmitting a signal over the other wire and of closing the first wire again after transmitting the signal.

523,124. ELECTRICAL SIGNAL BOX; W. W. Hibbard, Rochester, N. Y. Application filed August 12, 1893. The combination with a movable arm, resting over the face of the box, two manual stops, one in advance of the other, for restraining the movable arm, and an electrical stop succeeding the manual stops for restraining the arm, the electrical stop being controlled by an electromagnet.

523,132. MAGNETO CALL BOX; C. E. Scribner, Chicago, Ill. Application filed November 6, 1891. The combination with a calling generator, of a movable contact piece and a movable block, a fixed contact anvil and a fixed block mechanism in connection with the driving gear of the generator, allowing the movable block to bear against the fixed block and to close the movable contact piece upon the fixed contact piece when the generator is idle, and circuit connections joining the fixed block to a telephone line, the movable block and the movable contact piece to one end of the armature coil, the fixed contact anvil to the other end of the armature coil and to earth.

523,140. ELECTRIC MOTOR; J. F. Denison, New Haven, Conn. Application filed April 6, 1894. A barrel shaped armature core having a face curved in longitudinal section with alternate long and short ribs thereon, in the grooves between which are to be wound the armature coils.

523,144. ELECTRIC ARC LAMP; W. E. Frost, Lewiston, Me. Application filed July 31, 1893. The combination with top and bottom frame plates and posts connecting the same, of insulated collars surrounding the posts, and two part compound binding posts clamped together about the collars.

523,146. CONDUIT ELECTRIC RAILWAY; C. D. Jenney, Indianapolis, Ind. Application filed March 5, 1894. The combination in a conduit railway system of a conductor bar mounted to permit a vertical movement, frame work carrying the conductor bar and capable of a lateral movement, and springs attached to the bar and to the frame and operating to support or carry a portion of the weight of the bar.

523,160. ELECTRICAL CONDUCTOR; G. H. Blakesley, Briston, Conn. Application filed April 7, 1893. A flexible conductor consisting of a body of flat tape into the edges of which are incorporated previously insulated wires or cables for transmitting electricity.

523,161. MEANS FOR VENTILATING ARMATURES; T. C. Coykendall, Rondout, N. Y. Application filed October 17, 1893. The combination with a dynamo-electric machine or motor, of a pulley having arms and fan blades mounted on the inner face of the rim between the arms thereof.

523,164. SUPPLY SYSTEM FOR ELECTRIC RAILWAYS; E. H. Johnson, New York, and Robert Lundell, Brooklyn, N. Y. Application filed December 19, 1893. A conducting contact brush secured by a pair of links or arms to a rigid support beneath the body of a car or vehicle, the arms being located in the same vertical plane and having parallel movement therein.

523,165. SUPPLY SYSTEM FOR ELECTRIC RAILWAYS; E. H. Johnson, New York, and Robert Lundell, Brooklyn, N. Y. Application filed January 16, 1894. A sliding contact brush detachably secured to a brush support having pivoted connection through a cross bar or standard with the body of a car or vehicle, in combination with a spring connecting the brush support and its sustaining standard whereby the brush is given positive downward pressure against the trolley conductor as the car advances.

523,166. SUPPLY SYSTEM FOR ELECTRIC RAILWAYS; E. H. Johnson, New York, and Robert Lundell, Brooklyn, N. Y. Application filed February 10, 1894. An electric railway provided with an insulating conduit and a series of branch or sub-feeder insulating conduits, the feeder conduit being embedded in the roadway and the sub-feeder conduits having their exterior ends secured in an insulating stringer or support which sustains a series of sectional trolley conductors.

523,172. ELECTRIC RAILWAY CROSSING INSULATOR; H. B. Nichols and F. H. Lincoln, Philadelphia, Pa. Application filed May 9, 1894. This comprises an arm of insulating material with a slotted and recessed body and having channeled metal wings with projections and detachable clamps, a seat of insulating material engaging the recesses portion of the arm, channelled metal arms formed with a slotted or recessed casting provided with forked ends engaging the arm and having curved projections on both sides thereof, and detachable clamps connected with the metal arms.

523,204. INCANDESCENT LAMP; W. E. Forest, New York. Application filed August 1, 1893. The combination of a globe provided with a conical neck, a perforated stopper fitted to the narrower portion of the conical neck, a perforated stopper fitted to the wider portion of the conical neck, a glass tube provided with leading wires inserted in the stoppers, and a body of plastic cement surrounding the glass tube and filling the space between the glass tube, the inner wall of the conical neck and the adjacent surfaces of the conical neck.

523,247. MAGNETO-ELECTRIC MACHINE; E. Tilmann, New York. Application filed November 22, 1893. An armature for magneto machines composed of a diametrical core, coils wound on the core, an insulating partition separating the coils and core plates extending over the coils.

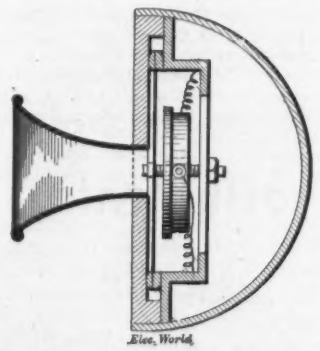
523,264. MATERIAL FOR MAKING ELECTRIC LIGHT FILAMENTS; G. A. Cannot, London, England. Application filed December 12, 1893. This consists of a thin yarn of peat fibre carbonized and treated in the ordinary way.

523,271. CONDUIT ELECTRIC RAILWAY; J. W. Eisenhuth, San Francisco, Cal. Application filed March 12, 1894. The combination of supporting chairs, an insulated conduit mounted thereon, an insulating partition dividing the conduit, conducting the wires mounted on each side of the partition in the conduit but insulated therefrom, and a trolley adapted to engage the conducting wires.

523,276. TELEPHONE TRANSMITTER; T. Grissinger, Mechanicsburg, Pa. Application filed May 24, 1894. In a telephone transmitter the combination with a diaphragm and fixed electrodes laterally connected with conducting wires, of a granulated variable resistance medium confined in contact with the electrodes and a plunger connected with the diaphragm and arranged to exert a varying pressure on the granulated material. (See illustration.)

523,278. ELECTRIC RAIL BOND; J. G. Hallas, Waterbury, Conn. Application filed May 1, 1894. A bond for rails of electric roads consisting of a body of uniform size having one or more coils formed from the metal of the bond, the ends adapted to be passed through adjoining rails, angular shoulders formed by bending the metal at a right angle, and which are adapted to set up against the under sides of the rails and the ends of the bonds to be headed down on the upper sides.

523,284. BONDING JOINT FOR ELECTRIC RAILWAYS; A. L. Johnston, Richmond, Va. Application filed May 5, 1894. The combination of a rail per-



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forated to receive a bonding connection, a bonding wire, with a nut adapted to the hole in the rail, the nut having a flange adapted to bear against the surface of the rail.

523,305. INCANDESCENT ELECTRIC LAMP; J. E. Criggal, Springfield, Mass. Application filed June 11, 1894. A tube of glass having the leading in wire which is extended longitudinally through it, a vitrified substance in the lower portion of the tube, a body of rubber cement next above and a body of plaster closing the mouth at the top of the tube.

523,306. ELECTRIC RAILWAY; H. A. Doty, Janesville, Wis. Application filed March 27, 1894. A conductor for electric railways, comprising a covered wire and thin, flat, bare, projecting lugs rigidly secured to the wire and in longitudinal alignment.

523,313. ELECTRIC RAILWAY SYSTEM; R. M. Hunter, Philadelphia, Pa. Application filed March 14, 1889. The combination of a positive and negative working conductor for supplying current to the motors on the cars, a generator having one of its poles connected to one conductor, and its other pole connected with the other conductor through a variable resistance.

523,319. ELECTRICAL CONDUCTOR FOR TROLLEYS; J. W. Eisenhuth, San Francisco, Cal. This comprises a main conductor of low resistance and a series of short tubular conductors, each having permanent electrical connection with trolleys, etc.